Table A-1. 303(d) listed waterbodies in the Wissahickon Creek basin for nutrients

Segment Name	Segment ID	Stream Code	Miles Affected	Human Health	Aquatic Life	Source	TMDL Priority
Wissahickon Creek	971218-1345-ACE	844	3.09	0	1	Municipal Point Source; Urban Runoff/Storm Sewers	Medium
Wissahickon Creek	971209-1430-ACE	844	6.24	0	1	Municipal Point Source; Urban Runoff/Storm Sewers	Medium
Wissahickon Creek	971209-0930-ACE	844	6.04	0	1	Municipal Point Source; Urban Runoff/Storm Sewers	Medium
Wissahickon Creek	971222-0930-ACE	844	1.83	0	1	Municipal Point Source; Urban Runoff/Storm Sewers	Medium
Wissahickon Creek	971222-1130-ACE	844	3.12	0	1	Municipal Point Source; Urban Runoff/Storm Sewers	Medium
Lorraine Run	971215-1000-ACE	856	2.22	0	1	Urban Runoff/Storm Sewers	Medium
Sandy Run	971215-1133-ACE	859	6.14	0	1	Municipal Point Source; Urban Runoff/Storm Sewers	Medium
Pine Run	971215-1303-ACE	860	3.51	0	1	Municipal Point Source; Urban Runoff/Storm Sewers	Medium
Pine Run	971215-1300-ACE	861	0.62	0	1	Urban Runoff/Storm Sewers	Medium
Pine Run	971215-1300-ACE	862	2.43	0	1	Urban Runoff/Storm Sewers	Medium
Pine Run	971215-1300-ACE	863	0.49	0	1	Urban Runoff/Storm Sewers	Medium
Pine Run	971215-1300-ACE	864	0.52	0	1	Urban Runoff/Storm Sewers	Medium
Pine Run	971215-1300-ACE	865	0.93	0	1	Urban Runoff/Storm Sewers	Medium
Pine Run	971215-1300-ACE	866	1.48	0	1	Urban Runoff/Storm Sewers	Medium
Pine Run	971215-1300-ACE	867	0.53	0	1	Urban Runoff/Storm Sewers	Medium

Pine Run	971215-1300-ACE	868	0.42	0	1	Urban Runoff/Storm Sewers	Medium
Sandy Run*	971215-1133-ACE	869	0.73	0	1	Urban Runoff/Storm Sewers	Medium
Sandy Run	971215-1300-ACE	870	0.42	0	1	Urban Runoff/Storm Sewers	Medium
Trewellyn Creek	971217-1145-ACE	886	3.27	0	1	Urban Runoff/Storm Sewers	Medium
Trewellyn Creek	971217-1145-ACE	887	1.03	0	1	Urban Runoff/Storm Sewers	Medium
Trewellyn Creek	971217-1145-ACE	888	0.61	0	1	Urban Runoff/Storm Sewers	Medium
Trewellyn Creek	971217-1145-ACE	889	0.65	0	1	Urban Runoff/Storm Sewers	Medium
Trewellyn Creek	971217-1145-ACE	890	0.42	0	1	Urban Runoff/Storm Sewers	Medium

*Segment 869 is a small millrace and not actually a trib to Sandy Run. PA DEP stated that 869 may be removed from list due to insignificance.

Table A-2. 303(d) listed waterbodies in the Wissahickon Creek basin for siltation

Segment Name	Segment ID	Stream Code	Miles Affected	Human Health	Aquatic Life	Source	TMDL Priority
Wissahickon Creek	971209-0930-ACE	844	6.04	0	1	Urban Runoff/Storm Sewers	Medium
Wissahickon Creek	971209-1430-ACE	844	6.24	0	1	Urban Runoff/Storm Sewers	Medium
Wissahickon Creek	971218-1045-ACE	844	4.02	0	1	Urban Runoff/Storm Sewers	Medium
Wissahickon Creek	971218-1345-ACE	844	3.09	0	1	Urban Runoff/Storm Sewers	Medium
Wissahickon Creek	971222-0930-ACE	844	1.83	0	1	Urban Runoff/Storm Sewers	Medium
Wissahickon Creek	971222-1130-ACE	844	3.12	0	1	Urban Runoff/Storm Sewers	Medium
Monoshone Creek	971208-1430-ACE	845	0.48	0	1	Urban Runoff/Storm Sewers	Medium
Cresheim Creek	971209-1200-ACE	846	0.99	0	1	Urban Runoff/Storm Sewers	Medium
Valley Road Tributary	971208-1235-ACE	847	1.32	0	1	Urban Runoff/Storm	Medium

Segment Name	Segment ID	Stream Code	Miles Affected	Human Health	Aquatic Life	Source	TMDL Priority
						Sewers	
Cresheim Creek	971209-1200-ACE	848	1.68	0	1	Urban Runoff/Storm Sewers	Medium
Cresheim Creek	971209-1200-ACE	849	0.21	0	1	Urban Runoff/Storm Sewers	Medium
Cresheim Creek	971209-1200-ACE	850	0.44	0	1	Urban Runoff/Storm Sewers	Medium
Wises Mill Tributary	971208-1000-ACE	851	0.83	0	1	Urban Runoff/Storm Sewers	Medium
Wises Mill Tributary	971208-1000-ACE	852	0.6	0	1	Urban Runoff/Storm Sewers	Medium
Wises Mill Tributary	971208-1000-ACE	853	0.86	0	1	Urban Runoff/Storm Sewers	Medium
Paper Mill Run	971211-1300-ACE	854	2.31	0	1	Urban Runoff/Storm Sewers	Medium
Paper Mill Run	971211-1300-ACE	855	1.26	0	1	Urban Runoff/Storm Sewers	Medium
Lorraine Run	971215-1000-ACE	856	2.22	0	1	Surface Mining	Medium
Tributary Downstream of Sandy Run	971215-1130-ACE	857	2.5	0	1	Urban Runoff/Storm Sewers	Medium
Tributary Downstream of Sandy Run	971215-1130-ACE	858	0.93	0	1	Urban Runoff/Storm Sewers	Medium
Sandy Run	971215-1133-ACE	859	6.14	0	1	Urban Runoff/Storm Sewers	Medium
Pine Run	971215-1303-ACE	860	3.51	0	1	Urban Runoff/Storm Sewers	Medium
Pine Run	971215-1300-ACE	861	0.62	0	1	Urban Runoff/Storm Sewers	Medium
Pine Run	971215-1300-ACE	862	2.43	0	1	Urban Runoff/Storm Sewers	Medium
Pine Run	971215-1300-ACE	863	0.49	0	1	Urban Runoff/Storm Sewers	Medium
Pine Run	971215-1300-ACE	864	0.52	0	1	Urban Runoff/Storm Sewers	Medium
Pine Run	971215-1300-ACE	865	0.93	0	1	Urban Runoff/Storm Sewers	Medium

Segment Name	Segment ID	Stream Code	Miles Affected	Human Health	Aquatic Life	Source	TMDL Priority
Pine Run	971215-1300-ACE	866	1.48	0	1	Urban Runoff/Storm Sewers	Medium
Pine Run	971215-1300-ACE	867	0.53	0	1	Urban Runoff/Storm Sewers	Medium
Pine Run	971215-1300-ACE	868	0.42	0	1	Urban Runoff/Storm Sewers	Medium
Sandy Run*	971215-1133-ACE	869	0.73	0	1	Urban Runoff/Storm Sewers	Medium
Sandy Run	971215-1300-ACE	870	0.42	0	1	Urban Runoff/Storm Sewers	Medium
Tributary Downstream of Rose Valley Tributary	971216-1415-ACE	873	0.92	0	1	Urban Runoff/Storm Sewers	Medium
Tributary Downstream of Rose Valley Tributary	971216-1415-ACE	877	2.44	0	1	Urban Runoff/Storm Sewers	Medium
Rose Valley Tributary	971216-1415-ACE	878	2.64	0	1	Urban Runoff/Storm Sewers	Medium
Rose Valley Tributary	971216-1415-ACE	879	1.73	0	1	Urban Runoff/Storm Sewers	Medium
Rose Valley Tributary	971216-1415-ACE	880	0.27	0	1	Urban Runoff/Storm Sewers	Medium
Tributary Upstream of Rose Valley Tributary	971216-1415-ACE	881	0.85	0	1	Urban Runoff/Storm Sewers	Medium
Tributary Downstream of Willow Run - East	971217-1015-ACE	882	0.95	0	1	Urban Runoff/Storm Sewers	Medium
Tributary Downstream of Willow Run - East	971217-1015-ACE	884	1.42	0	1	Urban Runoff/Storm Sewers	Medium
Willow Run - East	971217-1015-ACE	885	2.11	0	1	Urban Runoff/Storm Sewers	Medium
Trewellyn Creek	971217-1145-ACE	886	3.27	0	1	Urban Runoff/Storm Sewers	Medium
Trewellyn Creek	971217-1145-ACE	887	1.03	0	1	Urban Runoff/Storm Sewers	Medium
Trewellyn Creek	971217-1145-ACE	888	0.61	0	1	Urban	Medium

Segment Name	Segment ID	Stream Code	Miles Affected	Human Health	Aquatic Life	Source	TMDL Priority
						Runoff/Storm Sewers	
Trewellyn Creek	971217-1145-ACE	889	0.65	0	1	Urban Runoff/Storm Sewers	Medium
Trewellyn Creek	971217-1145-ACE	890	0.42	0	1	Urban Runoff/Storm Sewers	Medium
North Wales Tributary	971217-1430-ACE	891	2.07	0	1	Urban Runoff/Storm Sewers	Medium
Tributary Upstream of North Wales Tributary	971217-1430-ACE	892	0.37	0	1	Urban Runoff/Storm Sewers	Medium
Tributary Upstream of North Wales Tributary	981015-1100-ACE	894	0.34	0	1	Habitat Modification	Medium
Tributary Upstream of North Wales Tributary	981015-1100-ACE	895	0.38	0	1	Habitat Modification	Medium
Tributary Upstream of North Wales Tributary	981015-1100-ACE	896	0.46	0	1	Habitat Modification	Medium
Tributary Upstream of North Wales Tributary	981015-1100-ACE	897	0.19	0	1	Habitat Modification	Medium

*Segment 869 is a millrace and not actually a tributary to Sandy Run. May be removed from list.

Table A-3. 303(d) listed waterbodies in the Wissahickon Creek basin for habitat alterations

Segment Name	Segment ID	Stream Code	Miles Affected	Human Health	Aquatic Life	Source	TMDL Priority
Wissahickon Creek	971218-1045-ACE	844	4.02	0	1	Habitat Modification	Low
Monoshone Creek	971208-1430-ACE	845	0.48	0	1	Habitat Modification	Low
Valley Road Tributary	971208-1235-ACE	847	1.32	0	1	Habitat Modification	Low
Wises Mill Tributary	971208-1000-ACE	851	0.83	0	1	Habitat Modification	Low
Wises Mill Tributary	971208-1000-ACE	852	0.6	0	1	Habitat Modification	Low
Wises Mill Tributary	971208-1000-ACE	853	0.86	0	1	Habitat Modification	Low
Paper Mill Run	971211-1300-ACE	854	2.31	0	1	Habitat Modification	Low
Paper Mill Run	971211-1300-ACE	855	1.26	0	1	Habitat Modification	Low
Lorraine Run	971215-1000-	856	2.22	0	1	Habitat	Low

Segment Name	Segment ID	Stream Code	Miles Affected	Human Health	Aquatic Life	Source	TMDL Priority
	ACE					Modification	
Tributary Downstream of Sandy Run	971215-1130-ACE	857	2.5	0	1	Habitat Modification	Low
Tributary Downstream of Sandy Run	971215-1130-ACE	858	0.93	0	1	Habitat Modification	Low
Sandy Run	971215-1133-ACE	859	6.14	0	1	Habitat Modification	Low
Pine Run	971215-1303-ACE	860	3.51	0	1	Habitat Modification	Low
Pine Run	971215-1300-ACE	861	0.62	0	1	Habitat Modification	Low
Pine Run	971215-1300-ACE	862	2.43	0	1	Habitat Modification	Low
Pine Run	971215-1300-ACE	863	0.49	0	1	Habitat Modification	Low
Pine Run	971215-1300-ACE	864	0.52	0	1	Habitat Modification	Low
Pine Run	971215-1300-ACE	865	0.93	0	1	Habitat Modification	Low
Pine Run	971215-1300-ACE	866	1.48	0	1	Habitat Modification	Low
Pine Run	971215-1300-ACE	867	0.53	0	1	Habitat Modification	Low
Pine Run	971215-1300-ACE	868	0.42	0	1	Habitat Modification	Low
Sandy Run*	971215-1133-ACE	869	0.73	0	1	Habitat Modification	Low
Sandy Run	971215-1300-ACE	870	0.42	0	1	Habitat Modification	Low
Tributary Downstream of Rose Valley Tributary	971216-1415-ACE	873	0.92	0	1	Habitat Modification	Low
Tributary Downstream of Rose Valley Tributary	971216-1415-ACE	877	2.44	0	1	Habitat Modification	Low
Rose Valley Tributary	971216-1415-ACE	878	2.64	0	1	Habitat Modification	Low
Rose Valley Tributary	971216-1415-ACE	879	1.73	0	1	Habitat Modification	Low
Rose Valley Tributary	971216-1415-ACE	880	0.27	0	1	Habitat Modification	Low
Tributary Upstream of Rose Valley Tributary	971216-1415-ACE	881	0.85	0	1	Habitat Modification	Low

* Segment 869 is a millrace and not actually a tributary to Sandy Run. May be removed from list.

Table A-4. 303(d) listed waterbodies in the Wissahickon Creek Basin for water/flow variability

Segment Name	Segment ID	Stream Code	Miles Affected	Human Health	Aquatic Life	Source	TMDL Priority
Wissahickon Creek	971209-0930-ACE	844	6.04	0	1	Urban Runoff/Storm Sewers	Low
Wissahickon Creek	971209-1430-ACE	844	6.24	0	1	Urban Runoff/Storm Sewers	Low
Wissahickon Creek	971218-1045-ACE	844	4.02	0	1	Urban Runoff/Storm Sewers; Other	Low
Wissahickon Creek	971218-1345-ACE	844	3.09	0	1	Urban Runoff/Storm Sewers; Other	Low
Wissahickon Creek	971222-0930-ACE	844	1.83	0	1	Urban Runoff/Storm Sewers	Low
Wissahickon Creek	971222-1130-ACE	844	3.12	0	1	Urban Runoff/Storm Sewers; Other	Low
Monoshone Creek	971208-1430-ACE	845	0.48	0	1	Urban Runoff/Storm Sewers	Low
Cresheim Creek	971209-1200-ACE	846	0.99	0	1	Urban Runoff/Storm Sewers	Low
Valley Road Tributary	971208-1235-ACE	847	1.32	0	1	Urban Runoff/Storm Sewers	Low
Cresheim Creek	971209-1200-ACE	848	1.68	0	1	Urban Runoff/Storm Sewers	Low
Cresheim Creek	971209-1200-ACE	849	0.21	0	1	Urban Runoff/Storm Sewers	Low
Cresheim Creek	971209-1200-ACE	850	0.44	0	1	Urban Runoff/Storm Sewers	Low
Wises Mill Tributary	971208-1000-ACE	851	0.83	0	1	Urban Runoff/Storm Sewers	Low
Wises Mill Tributary	971208-1000-ACE	852	0.6	0	1	Urban Runoff/Storm Sewers	Low
Wises Mill Tributary	971208-1000-ACE	853	0.86	0	1	Urban Runoff/Storm Sewers	Low
Paper Mill Run	971211-1300-ACE	854	2.31	0	1	Urban Runoff/Storm Sewers	Low
Paper Mill Run	971211-1300-ACE	855	1.26	0	1	Urban Runoff/Storm	Low

Segment Name	Segment ID	Stream Code	Miles Affected	Human Health	Aquatic Life	Source	TMDL Priority
						Sewers	
Lorraine Run	971215-1000-ACE	856	2.22	0	1	Surface Mining	Low
Tributary Downstream of Sandy Run	971215-1130-ACE	857	2.5	0	1	Urban Runoff/Storm Sewers; Other	Low
Tributary Downstream of Sandy Run	971215-1130-ACE	858	0.93	0	1	Urban Runoff/Storm Sewers; Other	Low
Sandy Run	971215-1133-ACE	859	6.14	0	1	Urban Runoff/Storm Sewers; Other	Low
Pine Run	971215-1303-ACE	860	3.51	0	1	Urban Runoff/Storm Sewers	Low
Pine Run	971215-1300-ACE	861	0.62	0	1	Urban Runoff/Storm Sewers	Low
Pine Run	971215-1300-ACE	862	2.43	0	1	Urban Runoff/Storm Sewers	Low
Pine Run	971215-1300-ACE	863	0.49	0	1	Urban Runoff/Storm Sewers	Low
Pine Run	971215-1300-ACE	864	0.52	0	1	Urban Runoff/Storm Sewers	Low
Pine Run	971215-1300-ACE	865	0.93	0	1	Urban Runoff/Storm Sewers	Low
Pine Run	971215-1300-ACE	866	1.48	0	1	Urban Runoff/Storm Sewers	Low
Pine Run	971215-1300-ACE	867	0.53	0	1	Urban Runoff/Storm Sewers	Low
Pine Run	971215-1300-ACE	868	0.42	0	1	Urban Runoff/Storm Sewers	Low
Sandy Run*	971215-1133-ACE	869	0.73	0	1	Urban Runoff/Storm Sewers; Other	Low
Sandy Run	971215-1300-ACE	870	0.42	0	1	Urban Runoff/Storm Sewers	Low

Segment Name	Segment ID	Stream Code	Miles Affected	Human Health	Aquatic Life	Source	TMDL Priority
Tributary Downstream of Rose Valley Tributary	971216-1415-ACE	873	0.92	0	1	Urban Runoff/Storm Sewers	Low
Tributary Downstream of Rose Valley Tributary	971216-1415-ACE	877	2.44	0	1	Urban Runoff/Storm Sewers	Low
Rose Valley Tributary	971216-1415-ACE	878	2.64	0	1	Urban Runoff/Storm Sewers	Low
Rose Valley Tributary	971216-1415-ACE	879	1.73	0	1	Urban Runoff/Storm Sewers	Low
Rose Valley Tributary	971216-1415-ACE	880	0.27	0	1	Urban Runoff/Storm Sewers	Low
Tributary Upstream of Rose Valley Tributary	971216-1415-ACE	881	0.85	0	1	Urban Runoff/Storm Sewers	Low
Tributary Downstream of Willow Run - East	971217-1015-ACE	882	0.95	0	1	Urban Runoff/Storm Sewers; Other	Low
Tributary Downstream of Willow Run - East	971217-1015-ACE	884	1.42	0	1	Urban Runoff/Storm Sewers; Other	Low
Willow Run - East	971217-1015-ACE	885	2.11	0	1	Urban Runoff/Storm Sewers; Other	Low
Trewellyn Creek	971217-1145-ACE	886	3.27	0	1	Urban Runoff/Storm Sewers	Low
Trewellyn Creek	971217-1145-ACE	887	1.03	0	1	Urban Runoff/Storm Sewers	Low
Trewellyn Creek	971217-1145-ACE	888	0.61	0	1	Urban Runoff/Storm Sewers	Low
Trewellyn Creek	971217-1145-ACE	889	0.65	0	1	Urban Runoff/Storm Sewers	Low
Trewellyn Creek	971217-1145-ACE	890	0.42	0	1	Urban Runoff/Storm Sewers	Low
North Wales Tributary	971217-1430-ACE	891	2.07	0	1	Urban Runoff/Storm Sewers; Other	Low

Segment Name	Segment ID	Stream Code	Miles Affected	Human Health	Aquatic Life	Source	TMDL Priority
Tributary Upstream of North Wales Tributary	971217-1430-ACE	892	0.37	0	1	Urban Runoff/Storm Sewers; Other	Low
Tributary Upstream of North Wales Tributary	981015-1100-ACE	894	0.34	0	1	Urban Runoff/Storm Sewers; Other	Low
Tributary Upstream of North Wales Tributary	981015-1100-ACE	895	0.38	0	1	Urban Runoff/Storm Sewers; Other	Low
Tributary Upstream of North Wales Tributary	981015-1100-ACE	896	0.46	0	1	Urban Runoff/Storm Sewers; Other	Low
Tributary Upstream of North Wales Tributary	981015-1100-ACE	897	0.19	0	1	Urban Runoff/Storm Sewers; Other	Low

* Segment 869 is a millrace and not actually a tributary to Sandy Run. May be removed from list.

Table A-5. 303(d) listed waterbodies in the Wissahickon Creek basin for low DO/organic enrichment

Segment Name	Segment ID	Stream Code	Miles Affected	Human Health	Aquatic Life	Source	TMDL Priority
Monoshone Creek	971208-1430-ACE	845	0.48	0	1	Urban Runoff/Storm Sewers	Medium
Valley Road Tributary	971208-1235-ACE	847	1.32	0	1	Urban Runoff/Storm Sewers	Medium

Table A-6. 303(d) listed waterbodies in the Wissahickon Creek basin for pathogens

Segment Name	Segment ID	Stream Code	Miles Affected	Human Health	Aquatic Life	Source	TMDL Priority
Monoshone Creek	971208-1430-ACE	845	0.48	1	0	Urban Runoff/Storm Sewers	High
Valley Road Tributary	971208-1235-ACE	847	1.32	1	0	Urban Runoff/Storm Sewers	High

Table A-7. 303(d) listed waterbodies in the Wissahickon Creek basin for chlorine

Segment Name	Segment ID	Stream Code	Miles Affected	Human Health	Aquatic Life	Source	TMDL Priority
Pine Run**	971215-1303-ACE	860	0.6*	0	1	Municipal Point Source	High

* Section of segment downstream of STP
** PA DEP plans to delist; additional sampling/documentation may be needed.

Table A-8. 303(d) listed waterbodies in the Wissahickon Creek basin for oil and grease

Segment Name	Segment ID	Stream Code	Miles Affected	Human Health	Aquatic Life	Source	TMDL Priority
Valley Road Tributary*	971208-1235-ACE	847	1.32	0	1	Urban Runoff/Storm Sewers	Medium

*As a result of 9/24/01 resurvey of stream, PA DEP plans to delist but may require additional sampling/documentation.

Location: Wissahickon at Mouth
Pollutant: NO3-N (mg/L)
Data from: 1/18/1990 to 7/13/2001 (123 Observations)

Flow Range	# Obs	Flow (cfs)			Concentration (mg/l)		
Percentile	*Count*	*Mean*	*Min*	*Max*	*Mean*	*Min*	*Max*
0-10	13	25.308	16.000	32.000	5.47	3.84	7.89
10-20	12	34.750	33.000	36.000	4.67	2.49	6.50
20-30	12	41.667	37.000	45.000	4.83	2.77	6.28
30-40	12	48.167	46.000	51.000	4.92	3.13	7.46
40-50	13	54.692	51.000	58.000	4.96	3.81	7.00
50-60	12	63.667	60.000	68.000	4.22	2.15	5.20
60-70	12	72.750	68.000	79.000	4.10	1.63	5.53
70-80	12	82.917	79.000	87.000	3.96	1.89	5.79
80-90	12	113.167	87.000	156.000	3.92	2.02	6.59
90-100	13	327.154	157.000	751.000	2.79	1.08	4.82

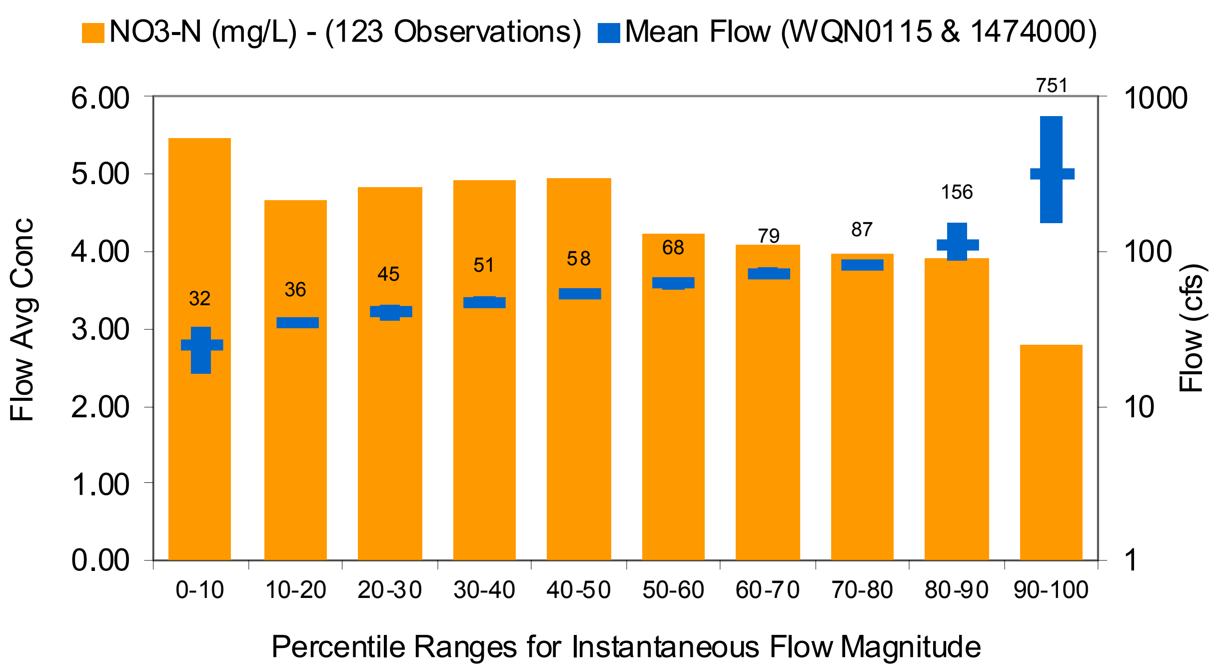

Figure B-1. Nitrate levels vs. streamflow magnitudes

Location: Wissahickon at Mouth
Pollutant: NO3-N (mg/L)
Data from: 1/18/1990 to 7/13/2001 (123 Observations)

Time Period	# Obs	Flow (cfs)			Concentration (mg/l)		
Month	*Count*	*Mean*	*Min*	*Max*	*Mean*	*Min*	*Max*
January	11	100.909	48.000	235.000	3.86	2.76	6.48
February	11	99.636	52.000	198.000	3.49	1.64	5.71
March	11	199.909	55.000	751.000	3.15	1.47	5.49
April	10	85.200	48.000	139.000	3.73	2.02	5.97
May	11	63.545	44.000	99.000	4.57	3.62	5.52
June	10	52.500	31.000	84.000	4.58	3.00	7.89
July	11	47.818	24.000	156.000	4.17	2.59	5.56
August	9	43.222	16.000	66.000	4.16	2.15	6.29
September	9	40.778	16.000	64.000	4.96	3.37	7.00
October	11	102.636	22.000	479.000	4.70	2.77	6.50
November	9	127.889	34.000	704.000	2.13	1.08	6.03
December	10	73.500	27.000	270.000	4.44	2.02	6.59

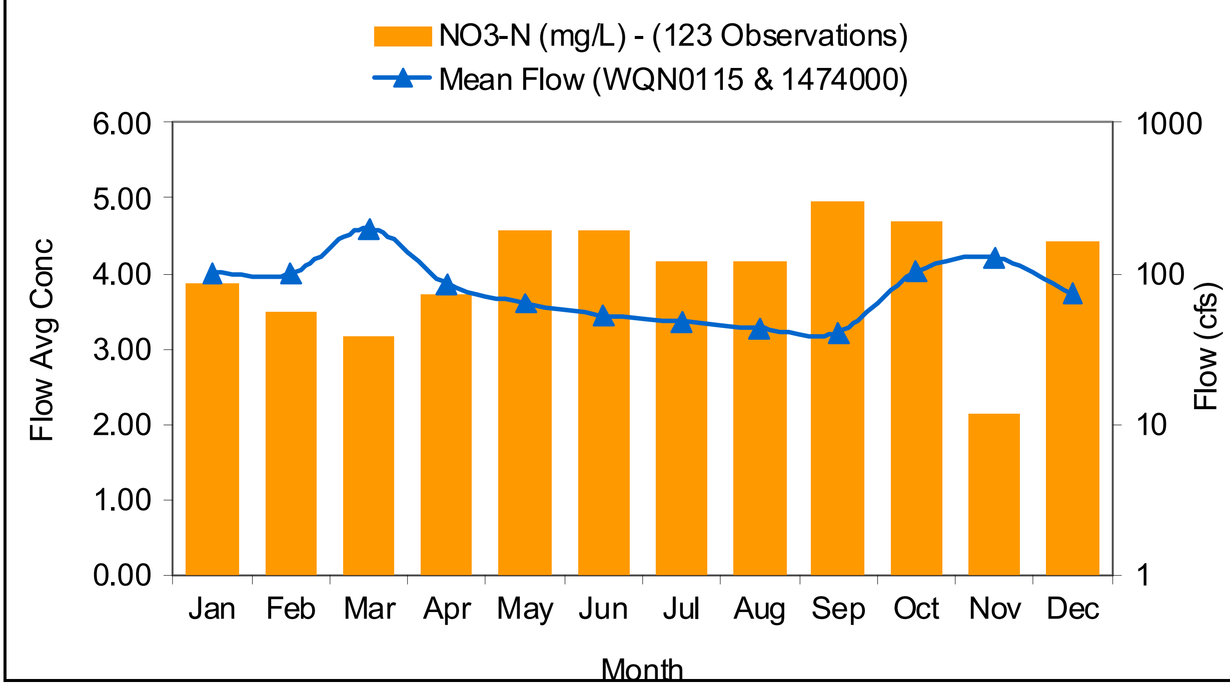

Figure B-2. Average nitrate levels and mean flow per month

Location: Wissahickon at Mouth
Pollutant: TP (mg/L)
Data from: 1/18/1990 to 7/26/2001 (123 Observations)

Flow Range	# Obs	Flow (cfs)			Concentration (mg/l)		
Percentile	*Count*	*Mean*	*Min*	*Max*	*Mean*	*Min*	*Max*
0-10	13	25.308	16.000	33.000	1.04	0.65	1.76
10-20	12	35.083	33.000	37.000	0.72	0.02	1.38
20-30	12	42.250	37.000	45.000	0.85	0.56	1.32
30-40	12	48.083	46.000	51.000	0.80	0.41	1.14
40-50	13	53.692	51.000	56.000	0.76	0.48	1.76
50-60	12	60.750	57.000	65.000	0.68	0.37	1.00
60-70	12	69.833	66.000	74.000	0.56	0.28	0.93
70-80	12	82.417	75.000	90.000	0.48	0.28	0.77
80-90	12	110.417	92.000	139.000	0.44	0.23	0.72
90-100	13	289.462	140.000	751.000	0.43	0.11	0.80

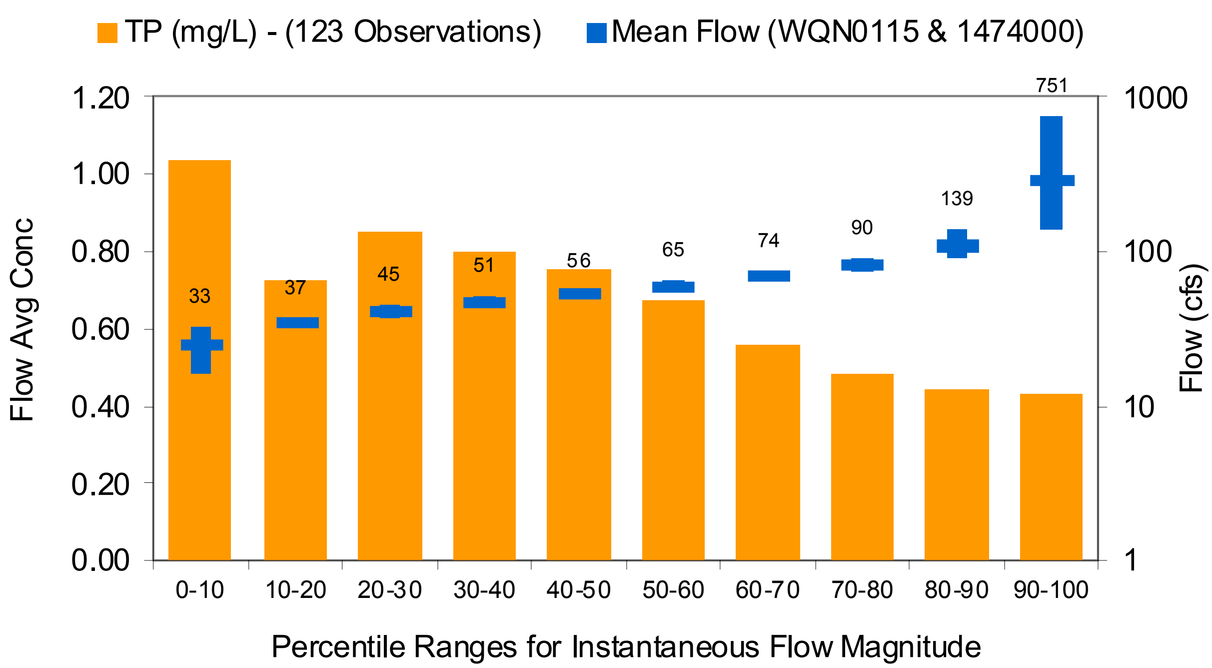

Figure B-3. Total phosphorus levels vs. streamflow magnitudes

Location: Wissahickon at Mouth
Pollutant: TP (mg/L)
Data from: 1/18/1990 to 7/26/2001 (123 Observations)

Time Period	# Obs	Flow (cfs)			Concentration (mg/l)		
Month	*Count*	*Mean*	*Min*	*Max*	*Mean*	*Min*	*Max*
January	11	84.364	48.000	170.000	0.53	0.30	1.76
February	11	94.818	60.000	196.000	0.45	0.22	0.75
March	12	163.000	55.000	751.000	0.39	0.27	0.77
April	9	85.111	48.000	139.000	0.48	0.28	1.10
May	12	62.750	44.000	99.000	0.64	0.28	1.32
June	9	50.000	31.000	84.000	0.69	0.41	1.14
July	12	52.917	21.000	156.000	0.71	0.02	1.25
August	8	41.000	16.000	66.000	0.75	0.52	1.34
September	10	41.400	16.000	64.000	0.76	0.45	1.20
October	11	99.818	22.000	479.000	0.55	0.38	1.14
November	9	126.444	34.000	704.000	0.78	0.52	1.38
December	9	74.111	27.000	270.000	0.48	0.11	1.76

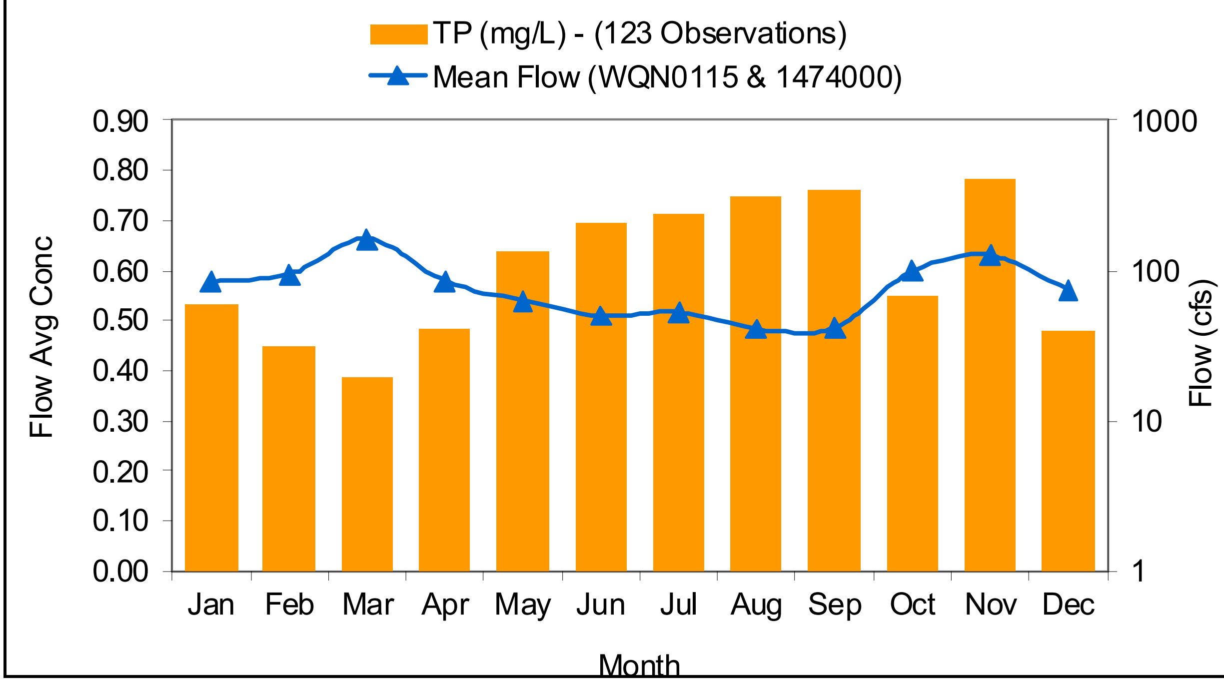

Figure B-4. Average total phosphorus levels and mean flow per month

Location: Wissahickon at Mouth
Pollutant: TSS (mg/L)
Data from: 1/18/1990 to 7/16/2001 (103 Observations)

Flow Range	# Obs	Flow (cfs)			Concentration (mg/l)		
Percentile	*Count*	*Mean*	*Min*	*Max*	*Mean*	*Min*	*Max*
0-10	11	2.000	2.000	2.000	56.18	23.00	162.00
10-20	10	2.000	2.000	2.000	62.90	16.00	157.00
20-30	10	2.000	2.000	2.000	134.80	55.00	479.00
30-40	11	2.000	2.000	2.000	51.00	35.00	80.00
40-50	10	2.600	2.000	4.000	71.19	36.00	232.00
50-60	10	4.800	4.000	6.000	65.44	22.00	177.00
60-70	10	7.800	6.000	10.000	65.38	16.00	112.00
70-80	11	11.182	10.000	14.000	66.68	27.00	170.00
80-90	9	14.222	14.000	16.000	90.91	21.00	196.00
90-100	11	56.273	16.000	303.000	473.50	24.00	751.00

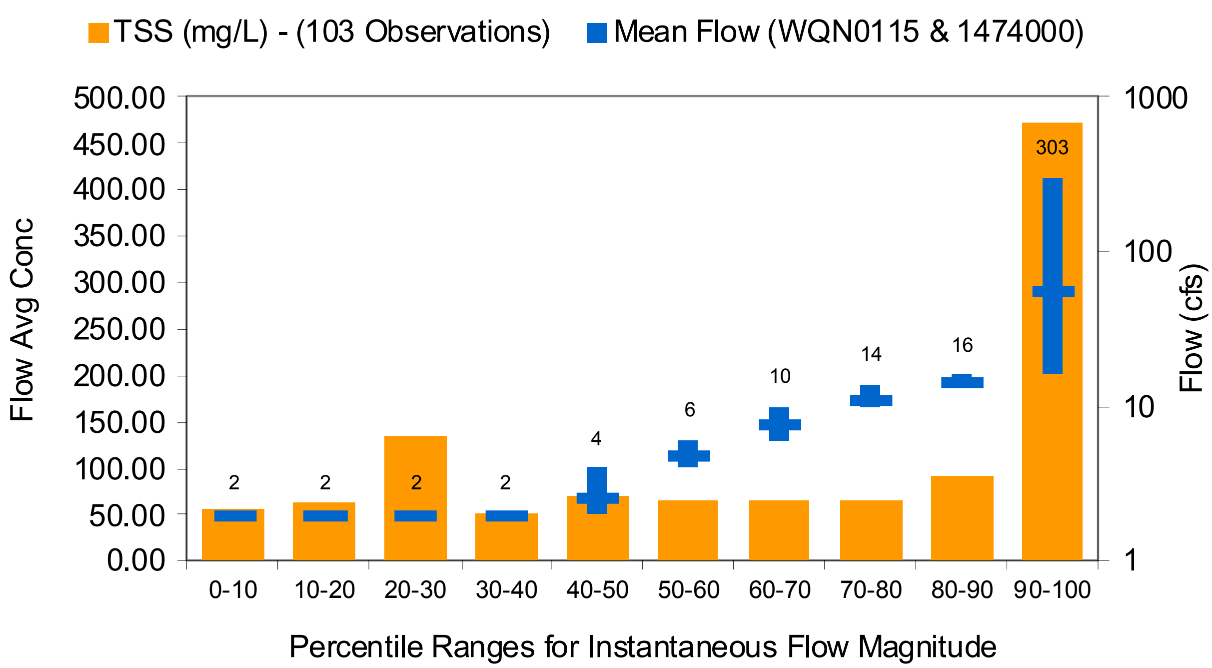

Figure B-5. Total suspended solids levels vs. streamflow magnitudes

Location: Wissahickon at Mouth
Pollutant: TSS (mg/L)
Data from: 1/18/1990 to 7/16/2001 (103 Observations)

Time Period	# Obs	Flow (cfs)			Concentration (mg/l)		
Month	*Count*	*Mean*	*Min*	*Max*	*Mean*	*Min*	*Max*
January	8	3.875	2.000	14.000	115.71	51.00	170.00
February	9	7.333	2.000	18.000	127.67	52.00	196.00
March	9	15.333	2.000	70.000	438.52	55.00	751.00
April	7	12.143	2.000	52.000	118.54	49.00	139.00
May	11	8.364	2.000	28.000	67.85	44.00	99.00
June	9	5.222	2.000	18.000	59.53	31.00	84.00
July	10	10.500	2.000	40.000	76.91	21.00	156.00
August	8	6.250	2.000	20.000	42.56	16.00	66.00
September	7	4.429	2.000	11.000	37.48	16.00	64.00
October	9	7.444	2.000	16.000	113.19	22.00	479.00
November	7	50.143	2.000	303.000	617.04	35.00	704.00
December	9	4.778	2.000	10.000	50.30	27.00	270.00

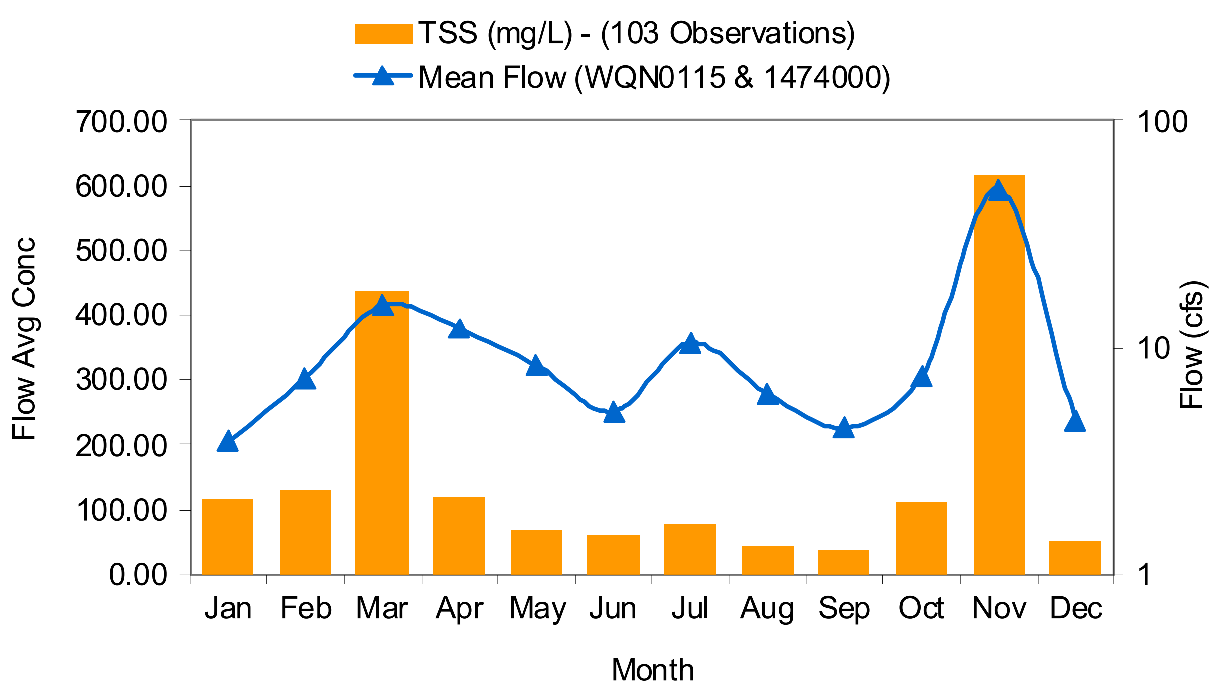

Figure B-6. Average total suspended solids levels and mean flow per month

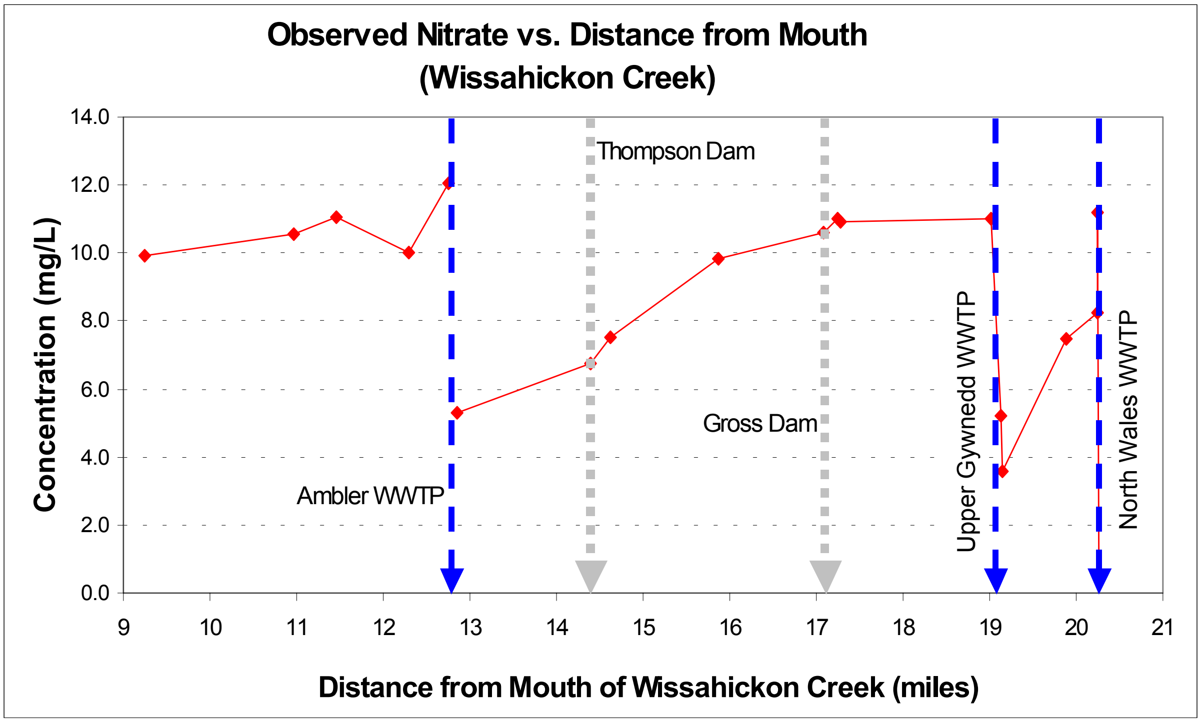

Figure C-1. Nitrate concentrations in Wissahickon Creek (Summer 2002)

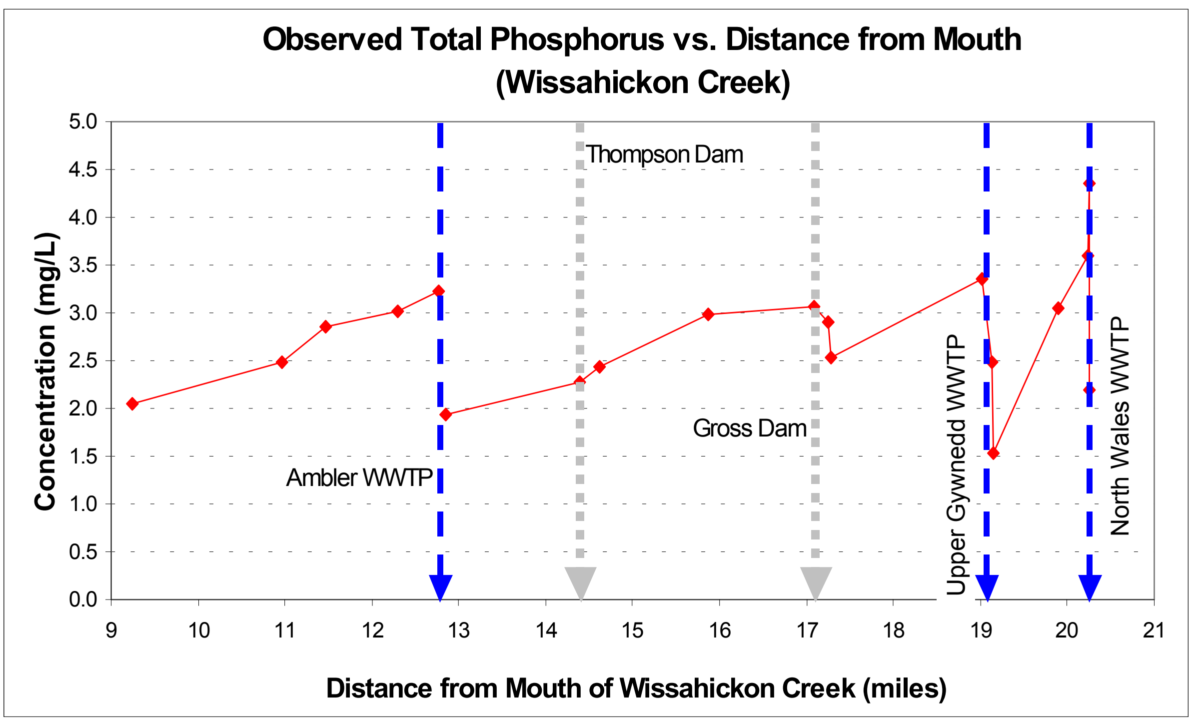

Figure C-2. Total phosphorus concentrations in Wissahickon Creek (Summer 2002)

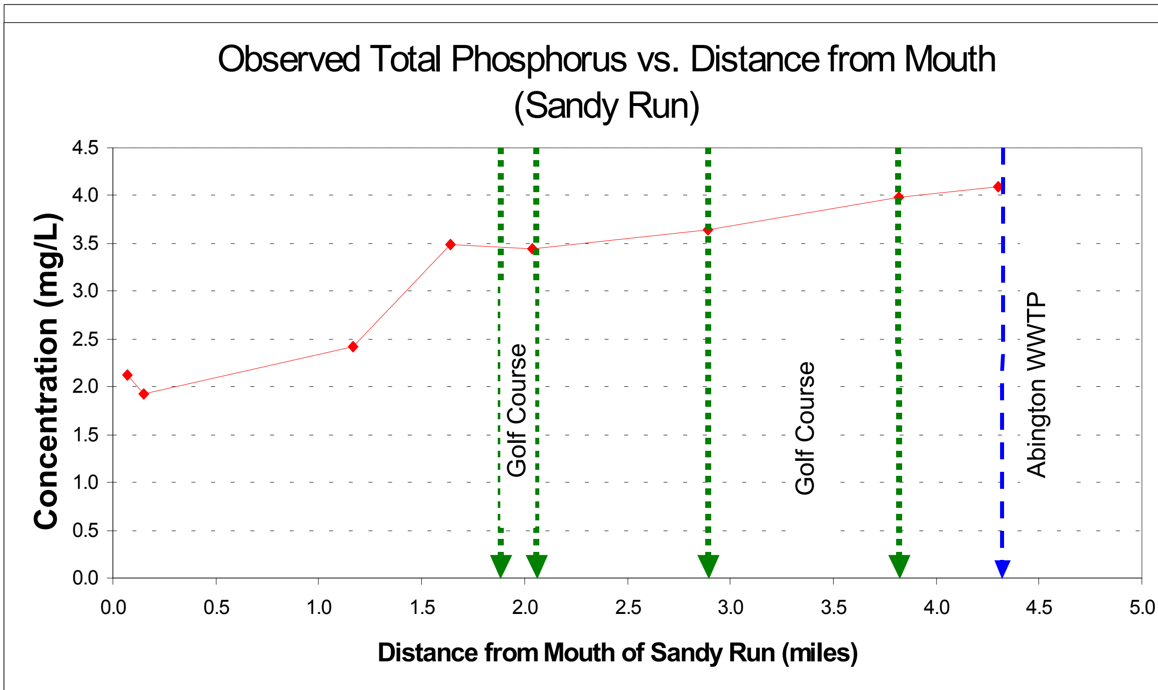

Figure C-5. Total phosphorus concentrations in Sandy Run (Summer 2002)

Distance from Mouth of Wissahickon Creek (miles)

Diurnal AM Diurnal PM Single Point

Figure C-3. Dissolved oxygen concentrations in Wissahickon Creek (Summer 2002)

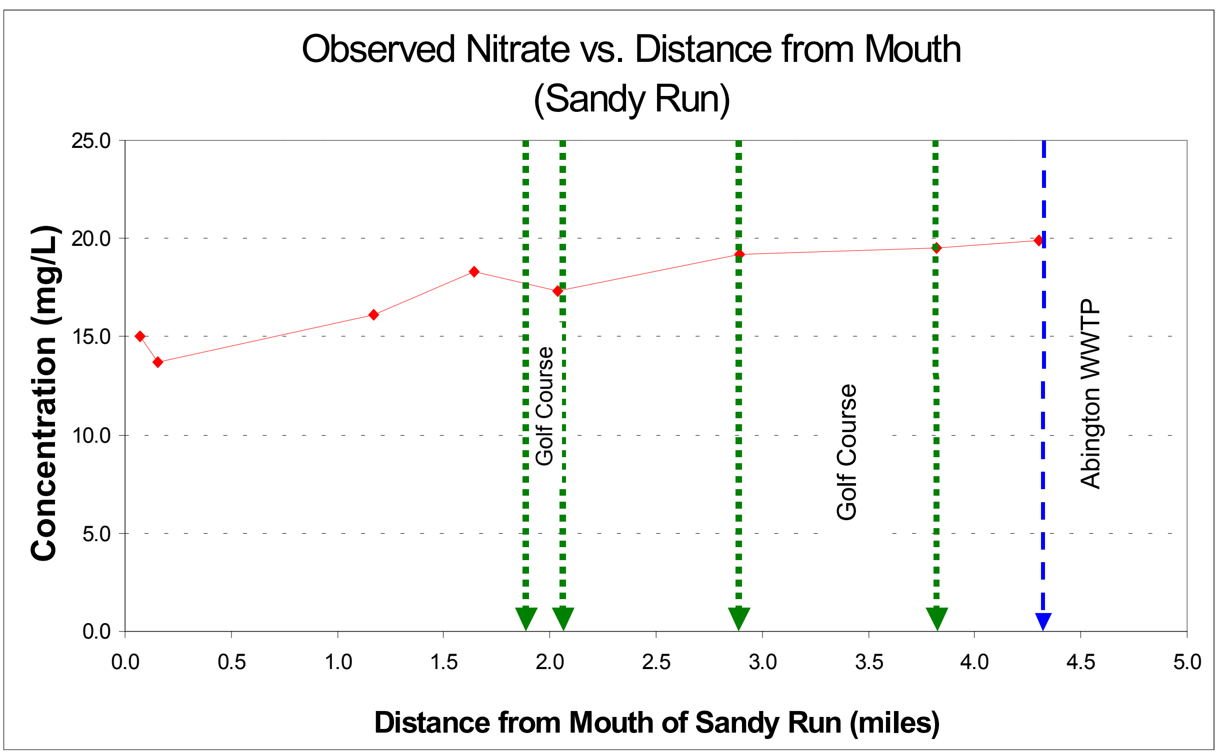

Figure C-4. Nitrate concentrations in Sandy Run (Summer 2002)

During the public comment period several commenters requested specific allocation options and stream conditions be considered by the Environmental Protection Agency (EPA). This Appendix will present the results of those requested considerations. All of the comparison runs shown in this Appendix are based on meeting the state water quality standard for trout stocking fishes of 5 mg/L daily minimum and 6 mg/L daily average.

I Impacts of Varying Flows from Loraine Run and Coorson's Quarry

Loraine Run receives flow from Coorson's Quarry. The present National Pollutant Discharge Elimination System (NPDES) permit for the quarry provides for a maximum flow and a minimum flow. The allocation runs for the Wissahickon Creek watershed were based on the higher flow of 8 CFS coming from the quarry. In order to determine if a reduced flow, one that would equal the lower flow allowed by the existing NPDES permit, would have an impact on the allocations assigned to the five significant point sources, EPA determined, using the water quality model, the allocations to the point sources necessary to meet water quality standards if the flow from the quarry were 0.5 CFS, the minimum allowed by the NPDES permit. It was found that no changes would result in the allocations. The table below provides the comparison of the allocations under the two quarry flows. .

Table D.1 - Impact of Varying Flow from Coorson's Quarry

WWTP ->	*North Wales*		*Upper Gwynedd*		*Ambler*		*Abington*		*Upper Dublin*	
Quarry -> flow	8 CFS	0.5 CFS	8 CFS	0.5 CFS	8 CFS	0.5 CFS	8 CFS	0.5 CFS	8 CFS	0.5 CFS
DO (mg/L)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
CBOD5 (mg/L)	3.00	3.00	5.00	5.00	10.00	10.00	7.50	7.50	12.75	12.75
NH3-N (mg/L)	0.50	0.50	0.74	0.74	1.50	1.50	0.72	0.72	2.25	2.25
NO3+NO2-N (mg/L)	15.15	15.15	17.64	17.64	36.40	36.40	25.92	25.92	38.57	38.57
ortho PO4-P (mg/L)	1.41	1.41	1.59	1.59	4.53	4.53	1.53	1.53	1.85	1.85

II. Impacts of Varying Effluent Dissolved Oxygen Concentrations

Existing permitted effluent minimum dissolved oxygen values range from 5 mg/l to 6 mg/l depending on the facility. The allocations presented in this TMDL report are based on an effluent dissolved oxygen minimum daily concentration of 7 mg/l. This concentration was chosen for the allocation runs based on numerous discussions with representatives of several of the municipal facilities.

In order to determine the impact of varying effluent dissolved oxygen concentrations, EPA performed modeling analysis assuming effluent dissolved oxygen concentrations from the five point sources of 6 mg/l, 7.5 mg/l, 7.75 mg/l and 8.0 mg/l. The following tables present the results of those analysis. It can be seen that as the effluent dissolved oxygen concentrations increase the allowable concentrations of the pollutants also increase slightly.

Table D-2 - Allocations at Effluent DO of 6.0 mg/L

	North Wales	Upper Gwynedd	Ambler	Abington	Upper Dublin
DO (mg/L)	6.0	6.0	6.0	6.0	6.0
CBOD5 (mg/L)	0.50	2.00	10.00	2.80	5.25
NH3-N (mg/L)	0.13	0.45	1.50	0.52	1.25
NO3+NO2-N (mg/L)	15.15	20.08	30.50	30.27	36.71
ortho PO4-P (mg/L)	0.47	1.11	4.68	1.39	1.64

Table D-3 - Allocations at Effluent DO of 7.0 mg/L

	North Wales	Upper Gwynedd	Ambler	Abington	Upper Dublin
DO (mg/L)	7.0	7.0	7.0	7.0	7.0
CBOD5 (mg/L)	3.00	5.00	10.00	7.50	12.75
NH3-N (mg/L)	0.50	0.74	1.50	0.72	2.25
NO3+NO2-N (mg/L)	15.15	17.64	36.40	25.92	38.57
ortho PO4-P (mg/L)	1.41	1.59	4.53	1.53	1.85

Table D-4 - Allocations at Effluent DO of 7.5 mg/L

	North Wales	Upper Gwynedd	Ambler	Abington	Upper Dublin
DO (mg/L)	7.5	7.5	7.5	7.5	7.5
CBOD5 (mg/L)	3.60	5.40	10.00	8.20	13.50
NH3-N (mg/L)	0.60	0.74	1.50	1.32	2.30
NO3+NO2-N (mg/L)	21.21	19.06	30.30	30.27	32.84
ortho PO4-P (mg/L)	1.55	1.71	4.68	2.92	1.96

Table D-5 - Allocations at Effluent DO of 7.75 mg/L

	North Wales	Upper Gwynedd	Ambler	Abington	Upper Dublin
DO (mg/L)	7.75	7.75	7.75	7.75	7.75
CBOD5 (mg/L)	3.90	5.50	10.00	8.30	13.65
NH3-N (mg/L)	0.65	0.77	1.50	1.32	2.30
NO3+NO2-N (mg/L)	21.21	19.06	30.30	30.27	32.84
ortho PO4-P (mg/L)	1.64	1.75	4.68	2.92	1.96

Table D-6 - Allocations at Effluent DO of 8.0 mg/L

	North Wales	Upper Gwynedd	Ambler	Abington	Upper Dublin
DO (mg/L)	8.0	8.0	8.0	8.0	8.0
CBOD5 (mg/L)	4.10	5.70	10.00	8.70	13.80
NH3-N (mg/L)	0.73	0.81	1.50	1.40	2.33
NO3+NO2-N (mg/L)	21.21	19.06	30.30	30.27	32.84
ortho PO4-P (mg/L)	1.74	1.79	4.68	3.15	1.98

III. Projected Impairments at Existing Permitted Flows and Concentrations

The water quality model was used to project the impairment in the Wissahickon Creek watershed when the five municipal facilities are built out and discharging at the levels that they are permitted to discharge. The model was used to determine the areas of the creek that will not meet the state water quality criteria for dissolved oxygen (for a trout stocking use) of 5 mg/l daily minimum and 6 mg/l daily average. Table D-7 shows the effluent concentrations that were used for thjis analysis. The effluent flows are the those that are allowed by the existing permit, the CBOD5, ammonia and effluent dissolved oxygen concentrations are those in required by the existing permit and, since nitrite-nitrate and phosphorus are not now permit limitations, the concentrations used are based on data collected by the facilities in 2002. The Table also shows the impact on the creek's dissolved oxygen, shown as percent of stream miles not meeting the state water quality standards. Figure D-1 shows the stream locations were the dissolved oxygen standard would not be met.

Figure D-7 - Stream Miles Impaired at Permit Conditions

	North Wales	Upper Gwynedd	Ambler	Abington	Upper Dublin	% Impaired for DO	
						Min DO of 5 mg/L	Ave DO of 6 mg/L
DO (mg/L)	6.0	6.0	6.0	6.0	6.0	45 percent of the stream miles in the Wissahickon Creek impaired	53 percent of the stream miles in the Wissahickon Creek Impaired
CBOD5 (mg/L)	10.00	10.00	10.00	10.00	15.00		
NH3-N (mg/L)	2.50	1.80	1.50	2.00	2.50		
NO3+NO2-N (mg/L)	15.15	12.60	18.20	21.60	20.30		
ortho PO4-P (mg/L)	4.69	3.12	4.53	3.82	2.94		

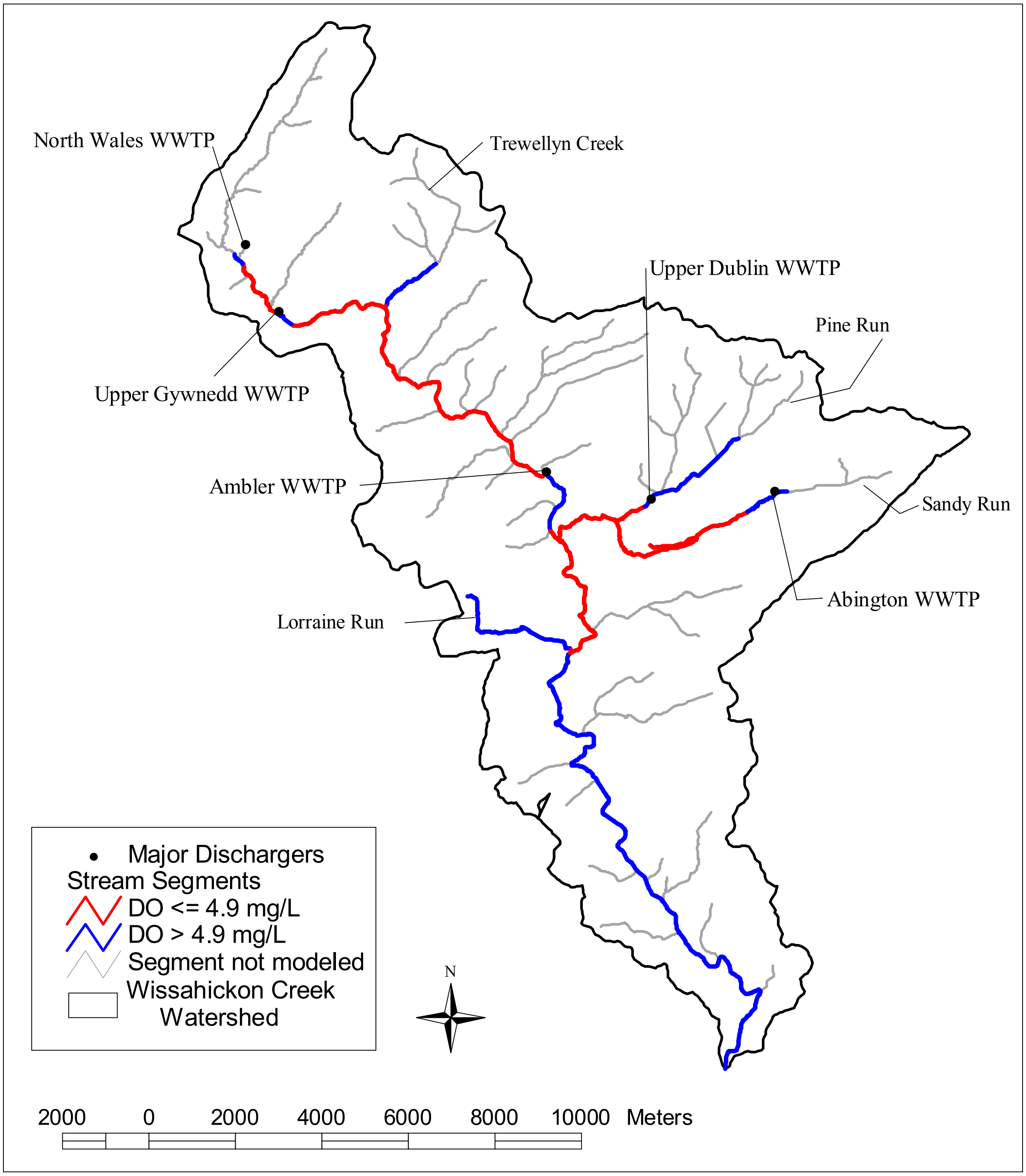
North Wales WWTP
Trewellyn Creek
Upper Dublin WWTP
Pine Run
Upper Gywnedd WWTP
Ambler WWTP
Sandy Run
Abington WWTP
Lorraine Run
Major Dischargers
Stream Segments
DO <= 4.9 mg/L
DO > 4.9 mg/L
Segment not modeled
Wissahickon Creek Watershed
N
2000 0 2000 4000 6000 8000 10000 Meters

Figure D-1 - Locations of Stream Standards Violations under Existing Permitted Conditions

IV. Impacts of Reducing Effluent Phosphorus Concentrations

There was interest by Pennsylvania Department of Environmental Protection (DEP) to evaluate the impacts reducing phosphorus on not only the allocations for the other pollutants based on a dissolved oxygen standard but also on the in stream phosphorus concentration. The focus of this TMDL has been on the protection of aquatic life by assuring that the state's water quality standard for dissolved oxygen is met. However, DEP has also indicated that control of nutrients may also be necessary to address other potential uses by humans by reducing nuisance algal growths. Control of nuisance algal growth may require in stream concentrations of phosphorus below that which is necessary in order to meet the dissolved oxygen standards. However, target phosphorus concentrations for this purpose are difficult to determine. Researchers involved in other TMDL studies[1] have estimated that in-stream concentrations of soluable phosphorus could range from as low as 1 to 4 ug/L (Spokane River) to above 100 ug/l (Tualatin River). For the Tualatin River, researchers found that a noticeable reduction in algal growth occurred at 100 ug/L phosphorus and at approximately 50 ug/L phosphorus, low growth conditions prevailed. Phosphorus indicators (TMDL endpoints) are not easy to implement in rivers and streams, particularly in fast-flowing, gravel or cobble bed streams which are impaired more by attached algae than free-floating algae. The relationship between phosphorus concentration and plant growth is not as well established in these systems, and in many ways the limiting nutrient may be so low as to be difficult to achieve.

EPA has made several model runs at various effluent phosphorus concentrations to determine the in-stream concentration of soluable phosphorus. These model runs were used to determine the levels of treatment necessary in order to have the in-stream concentrations fall within the research values noted above. Table D-8 below shows the range of in-stream PO4 based on varying the effluent Ortho Phosphorus concentrations. Since no algal growth studies have been performed on the Wissahickon Creek, the determination of the phosphorus concentration that would create a low, non-nuisance growth condition is not known. It is suggested that if after the phosphorus limits specified in this TMDL are met and algal growth continues at the nuisance level, stream specific studies be conducted to determine the low growth phosphorus concentrations for this specific water.

Table D-8 - In Stream PO4 at Various Effluent Concentrations

	Allocation Run	Effluent Ortho P = 0.5 mg/L	Effluent Ortho P = 0.1 mg/L
Range of in stream PO4 concentration	180 to 300 ug/L	30 to 60 ug/L	5 to 20 ug/L

[1] "Protocol for Developing Nutrient TMDLS - First Edition", EPA 841-B-89-007, November 1999.

Varying the Ortho Phosphorus in the effluent did not show a significant impact on the concentrations of the other pollutants needed in order to meet the state's water quality standards for dissolved oxygen. The following tables show the changes in the effluent concentrations when the Ortho Phosphorus is at the allocation concentration, at 0.5 mg/L and at 0.1 mg/L.

Table D-9 - Allocation Concentrations

	North Wales	Upper Gwynedd	Ambler	Abington	Upper Dublin
CBOD5 (mg/L)	3.00	5.00	10.00	7.50	12.75
NH3-N (mg/L)	0.50	0.74	1.50	0.72	2.25
NO3+NO2-N (mg/L)	15.15	17.64	36.40	25.93	38.57
ortho PO4-P (mg/L)	1.41	1.59	4.53	1.53	1.85

Table D-10 - Allocations with Ortho P at 0.5 mg/L

	North Wales	Upper Gwynedd	Ambler	Abington	Upper Dublin
CBOD5 (mg/L)	3.20	5.10	10.00	7.80	13.20
NH3-N (mg/L)	0.50	0.74	1.50	0.72	2.25
NO3+NO2-N (mg/L)	15.15	20.08	30.50	30.27	36.71
ortho PO4-P (mg/L)	0.50	0.50	0.50	0.50	0.50

Table D-11 - Allocations with Ortho P at 0.1 mg/L

	North Wales	Upper Gwynedd	Ambler	Abington	Upper Dublin
CBOD5 (mg/L)	3.20	5.20	10.00	8.00	13.50
NH3-N (mg/L)	0.50	0.74	1.50	0.72	2.25
NO3+NO2-N (mg/L)	15.15	20.08	30.50	30.27	36.71
ortho PO4-P (mg/L)	.10	0.10	0.10	0.10	0.10

V. Regionalized Treatment Options

The TMDL did not consider the possibility of regionalization, or combining several municipals' wastewater for treatment at one common facility . Because of the distances between facilities, it did not appear to be a likely alternative. However, there was a request to combine the flows of North Wales and Upper Gwynedd Township at the Upper Gwynedd facility. This request came at a late date in the development of the final TMDL, and so the necessary analysis was not complete in time for this report. However, EPA will pursue this request and perform an allocation run for the requested scenario. Results of this analysis will be made public as soon as possible.

E.0 Technical Approach for Siltation TMDL Devlopment

E.1 Reference Watershed Approach

TMDL development requires the identification of impairment causes and the establishment of numeric endpoints that will allow for the attainment of designated uses and water quality criteria. Numeric endpoints represent the water quality goals that are to be achieved by implementing the load reductions specified in the TMDL. Pennsylvania does not currently have numeric criteria for siltation. Therefore, a reference watershed approach was used to establish numeric endpoints for sediment in Wissahickon Creek. This approach is based on selecting a non-impaired watershed that shares similar land uses, ecoregions, and geomorphological characteristics with the impaired watershed. Stream conditions in the reference watershed are assumed to be representative of the conditions needed for the impaired stream to attain its designated uses. Loading rates for pollutants of concern are determined for impaired and reference watersheds through modeling studies. Both point and nonpoint sources are considered in the analysis of pollutant sources and in watershed modeling. Numeric endpoints are based on reference watershed loadings for pollutants of concern and load reductions necessary to meet these endpoints are determined. TMDL load allocation scenarios are then developed based on an analysis of the degree to which contributing sources can be reasonably reduced.

The reference watershed selection process is based on a comparison of key watershed and stream characteristics. The goal of the process is to select one or several similar, unimpaired reference watersheds that can be used to develop TMDL endpoints. Reference watershed selection was based on a desktop screening of nearby non-impaired watersheds with characteristics similar to those of the Wissahickon Creek watershed using several GIS coverages. The GIS coverages included the USGS watershed coverage, the state water plan boundaries, the satellite image-derived land cover grid (MRLC), stream reach coverage, Pennsylvania's 305(b) assessed streams database, the STATSGO soils database, and geological coverages.

Based on the aforementioned desktop GIS search for a reference watershed, the Ironworks Creek watershed, located in Bucks and Montgomery counties, was used to establish reference conditions and TMDL endpoints for the Wissahickon Creek watershed. The reference watershed was chosen based on the fact that it was an urban watershed that was not impaired by siltation and had similar physical characteristics to the Wissahickon Creek watershed (i.e., watershed size, landuse/cover, soils, geology, ecoregion). Table E-1 presents the characteristics of both the Wissahickon Creek and Ironworks Creek watersheds. Figure E-1 presents the location of the Ironworks Creek watershed.

Table E-1. Impaired and reference watershed comparison

	Wissahickon Creek	Ironworks Creek
Watershed Type	***Impaired Watershed***	***Reference Watershed***
Watershed Size (acres)	40,928	11,114
Geologic Province	Piedmont	Piedmont
Dominant Rock Types	Sandstone/Metamorphic-Igneous/Shale/Carbonate	Sandstone/Metamorphic-Igneous
Dominant Soils	C & B	C & B
Ecoregions	Triassic Lowlands Piedmont Uplands Piedmont Limestone Dolomite Lowlands	Triassic Lowlands Piedmont Uplands
Percent Slope of Watershed	0.25%	0.63%
Point Sources	14	0
Percent Urban	43%	44%
Percent Forested	40%	31%
Landuse Types:	**% Landuse**	**% Landuse**
Low Intensity Development	34.1%	39.8%
High Intensity Development	8.5%	4.2%
Hay/Pasture	7.1%	11.7%
Cropland	8.9%	10.9%
Conifer Forest	2.4%	1.8%
Mixed Forest	10.2%	10.3%
Deciduous Forest	28.0%	19.6%
Quarry	0.3%	0.0%
Coal Mine	0.02%	0.0%
Transitional	0.4%	0.1%

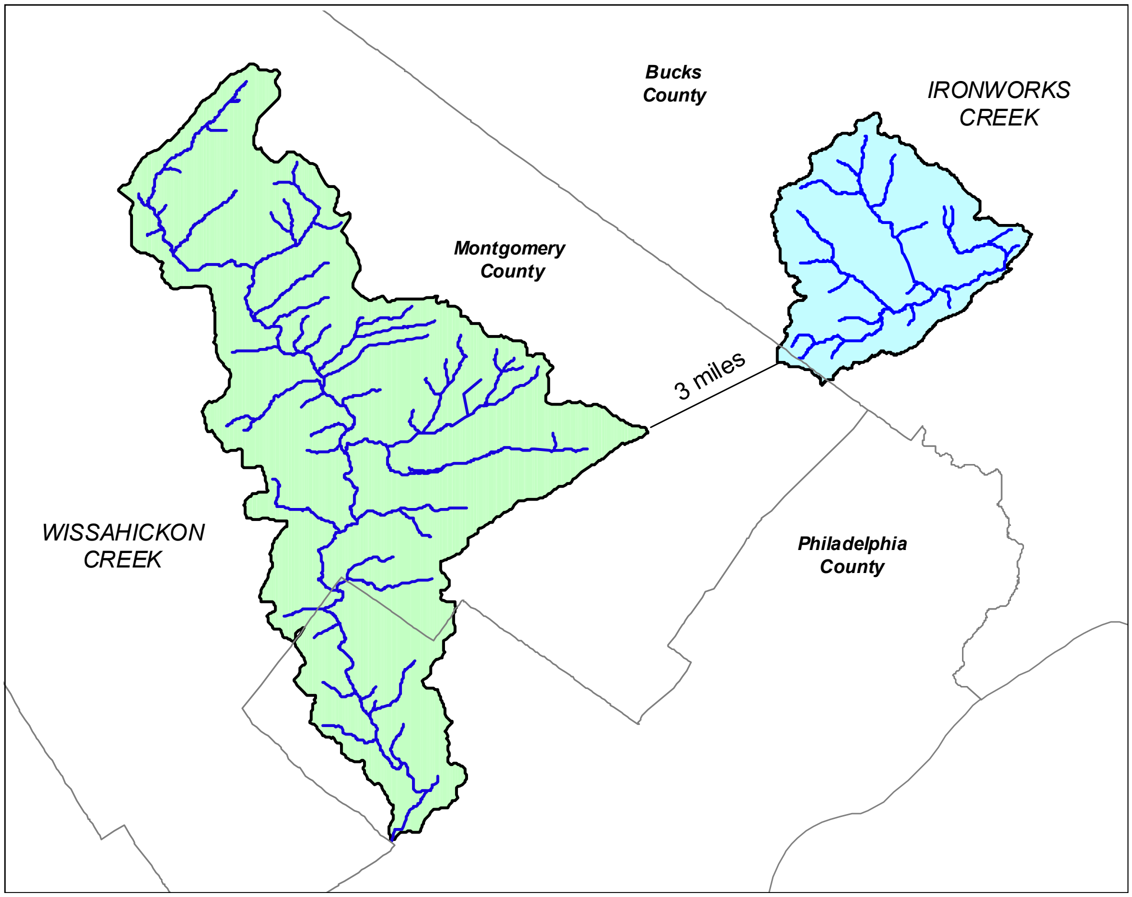

Figure E-1. Location of the reference watershed (Ironworks Creek)

Wissahickon Creek is a much larger watershed (40,928 acres) than Ironworks Creek (11,114 acres), therefore, Wissahickon Creek was delineated into five smaller watersheds that could easily be compared to Ironworks Creek (Figure E-2). Ironworks Creek was subsequently re-delineated to appropriately match each of the five subwatersheds in the Wissahickon Creek watershed.

To equate target and reference watershed areas for TMDL development, the total area for the reference watershed was adjusted to be equal to the area of its paired target watershed, after hydrology calibration. To accomplish this, land use areas (in the reference watershed) were proportionally adjusted based on the percent land use distribution. As a result, the total watershed area for Ironworks Creek was adjusted to be equal to the five modeled subwatersheds in Wissahickon Creek, respectively.

E.2 Overall Technical Approach

A reference watershed approach (see section E.1) was used in this study to develop siltation TMDLs for the Wissahickon Creek watershed. A watershed model was used to simulate sediment loads from potential sources in the impaired and reference watersheds. The watershed model used in this study was the Generalized Watershed Loading Functions (GWLF) model (Haith and Shoemaker 1987). GWLF modeling was accomplished using the AVGWLF watershed simulation program, which includes a GIS interface developed by the Environmental Resources Research Institute of the Pennsylvania State University (details in Section E.3). Numeric endpoints were based on the unit-area loading rates that were calculated for the reference watersheds. TMDLs were then developed for each impaired stream segment based these endpoints and the results from load allocation scenarios.

E.3 Watershed Model

The TMDLs were developed using the GWLF model. The GWLF model, which was originally developed by Cornell University (Haith and Shoemaker, 1987; Haith et al., 1992), provides the ability to simulate runoff, sediment, and nutrient loadings from watersheds given variable-size source areas (e.g., agricultural, forested, and developed land). It is a continuous simulation model that uses daily time steps for weather data and water balance calculations. Monthly calculations are made for sediment loads, based on the daily water balance accumulated to monthly values.

GWLF is an aggregated distributed/lumped parameter watershed model. For surface loading, it is distributed in the sense that it allows multiple land use/cover scenarios. Each area is assumed to be homogenous with respect to various attributes considered by the model. Additionally, the model does not spatially distribute the source areas, but aggregates the loads from each area into a watershed total. In other words, there is no spatial routing. Daily water balances are computed for an unsaturated zone as well as for a saturated subsurface zone, where infiltration is computed as the difference between precipitation and snowmelt minus surface runoff plus evapotranspiration.

GWLF models surface runoff using the Soil Conservation Service Curve Number (SCS-CN) approach with daily weather (temperature and precipitation) inputs. Erosion and sediment yield are estimated using monthly erosion calculations based on the Universal Soil Loss Equation (USLE) algorithm (with monthly rainfall-runoff coefficients) and a monthly composite of KLSCP values for each source area (e.g., land cover/soil type combination). The KLSCP factors are variables used in the calculations to depict changes in soil loss/erosion (K), the length/slope factor (LS), the vegetation cover factor (C), and the conservation practices factor (P). A sediment delivery ratio based on watershed size and a transport capacity based on average daily runoff are applied to the calculated erosion to determine sediment yield for each source area. Evapotranspiration is determined using daily weather data and a cover factor dependent on land use/cover type. Finally, a water balance is performed daily using supplied or computed precipitation, snowmelt, initial unsaturated zone storage, maximum available zone storage, and evapotranspiration values. All of the equations used by the model can be found in the original GWLF paper (Haith and Shoemaker, 1987) and GWLF User's Manual (Haith et. al, 1992).

In addition to the model functions described above, a streambank erosion routine was also used to determine the total sediment load to the watershed. The streambank erosion routine is based on an approach in which monthly streambank erosion is estimated by calculating a watershed-specific lateral erosion rate (LER) for streams in the watershed. The total sediment load in the watershed generated by streambank erosion is calculated by multiplying the LER by the total length of streams in the watershed, the average streambank height, and the average soil bulk density. For a more detailed discussion of the streambank erosion algorithm, see the AVGWLF Version 4.0 User's Guide (Evans et al. 2001).

Sediment point sources were not included in the GWLF model because GWLF is set up to include nutrient point sources, but not sediment point sources. There are 14 point sources of sediment in the Wissahickon Creek watershed (see Section 2.2.2). The sediment loads (in lbs/yr) from these point sources were calculated outside of the model based on their permitted flow and TSS concentration. The sediment delivery ration for the watershed in which each point source was located was applied to the total sediment load from that point source to determine the resulting sediment load at the mouth of the watershed after transport losses.

For execution, the model requires separate input files containing transport- and weather-related data. The transport file (TRANSPRT.DAT) defines the necessary parameters for each source area to be considered (e.g., area size, curve number) as well as global parameters (e.g., initial storage, sediment delivery ratio) that apply to all source areas. The weather file (WEATHER .DAT) contains daily average temperature and total precipitation values for each year simulated.

1.3.1 GIS-Based Derivation of Input Data for the Watershed Model

The primary sources of data for the TMDL analyses were GIS formatted databases. A specially designed interface, ArcView Version of the Generalized Watershed Loading Function (AVGWLF), was prepared by the Environmental Resources Research Institute of the Pennsylvania State University in ArcView (GIS software) to generate the data needed to run the GWLF model (Evans and Lehning, 2000; Evans et al., 2000).

In using the AVGWLF interface, the user is prompted to identify required GIS files and to provide other information related to "nonspatial" model parameters (e.g., beginning and end of the growing season, beginning and end date of available weather data). This information is subsequently used to automatically derive values for required model input parameters, which are then written to the TRANSPRT.DAT and WEATHER.DAT input files needed to execute the GWLF model. For use in Pennsylvania, AVGWLF has been linked with statewide GIS data layers such as land use/cover, soils, topography, and physiography, and it includes location-specific default information such as and cropping practices. Complete GWLF-formatted weather files also are prepared for 88 weather stations around the state.

Table E-2 lists the GIS data sets and provides an explanation of how they were used for development of the input files for the GWLF model.

Table E-2. Statewide GIS data sets (Source: Evans and Lehning, 2000; Evans et al., 2000)

County	The county boundaries coverage lists data on conservation practices that provide C and P values for the Universal Soil Loss Equation (USLE)
Landuse5	Grid of the Multi-Resolution Land Characteristics (MRLC, 1991-1993) that has been reclassified into five categories. This is used primarily as background.
Majroad	Coverage of major roads. Used for reconnaissance of a watershed.
MCD	Minor civil dividions (boroughs, toenships, and cities)
NPDES	A coverage of permitted point sources. Provides background information and cross check for the point source coverage.
PADEM	100-meter digital elevation model. This is used to calculate landslope and slope length.
PALUMRLC	A satellite image-derived land cover grid (MRLC) that is classified into 15 different land cover categories. This data set provides land cover loading rates for the different categories in the model.
Pasingle	The 1:24,000 scale single-line stream coverage of Pennsylvania. Provides a complete network of streams with coded stream segments.
Physprov	A shapefile of physiographic provinces. Attributes *rain_cool* and *rain_warm* are used to set rainfall erosivity, and *gwrecess* is used to set recession coefficients.
Pointsrc	Major point source discharges with permitted nitrogen and phosphorus loads.

Smallsheds	A coverage of small watersheds for named streams at the 1:24,000 scale. This coverage is used with the stream network to delineate the desired watershed level.
STATSGO	A shape file of generalized soil boundaries. The attribute *mu_k* sets the k factor in the USLE. The attribute *mu_awc* is the unsaturated available capacity, and the *muhsg_dom* is used with land use/cover to derive curve numbers.
Strm305	A coverage of stream water quality as reported in Pennsylvania's 305(b) report. Current status of assessed streams.
Surfgeol	A shapefile of the surface geology used to compare watersheds with similar qualities.
Zipcode	A coverage of animal densities. Attribute *aeu_acre* helps estimate nitrogen and phosphorus concentrations in runoff in agricultural lands and over manured areas.
Weather Files	Historical weather files for stations around Pennsylvania to simulate flow.

As described in the Watershed Model section (E.3), the GWLF model provides the ability to simulate surface water runoff, as well as sediment loads, from a watershed based on landscape conditions such as topography, land use/cover, and soil type. In essence, the model is used to estimate surface runoff and nonpoint source loads from different areas in the watershed.

E.3.2 Explanation of Important Model Parameters

In the GWLF model, the nonpoint source load calculated is affected by terrain conditions such as amount of agricultural land, land slope, and inherent soil erodibility. It also is affected by farming practices used in the area, as well as by background concentrations of nutrients (nitrogen and phosphorus) in soil and groundwater. Various parameters are included in the model to account for these conditions and practices. Some of the more important parameters are summarized below:

Areal extent of different land use/cover categories: This parameter is calculated directly from a GIS layer of land use/cover.

Curve number: This parameter determines the amount of precipitation that infiltrates into the ground or enters surface water as runoff. It is based on specified combinations of land use/cover and hydrologic soil type and is calculated directly using digital land use/cover and soils layers.

K factor: This factor relates to inherent soil erodibility, and it affects the amount of soil erosion taking place on a given unit of land.

LS factor: This factor signifies the steepness and length of slopes in an area and directly affects the amount of soil erosion.

C factor: This factor is related to the amount of vegetative cover in an area. In agricultural areas, this factor is largely controlled by the crops grown and the cultivation practices used. Values range from 0 to 1.0, with larger values indicating greater potential for erosion.

P factor: This factor is directly related to the conservation practices used in agricultural areas. Values range from 0 to 1.0, with larger values indicating greater potential for erosion.

Sediment delivery ratio: This parameter specifies the percentage of eroded sediment delivered to surface water and is empirically based on watershed size.

Unsaturated available water-holding capacity: This parameter relates to the amount of water that can be stored in the soil and affects runoff and infiltration. It is calculated using a digital soils layer.

More detailed information about the parameters and outlined above can be obtained from the GWLF User's Manual (Haith et al., 1992). Specific details in the manual that describe equations and typical parameter values used can be found on pages 15 through 41.

E.3.3 Meteorological Data

Local rainfall and temperature data were used to simulate flow conditions in modeled watersheds. Hourly precipitation and daily temperature data were obtained from local National Climatic Data Center (NCDC) weather stations and other sources. Daily maximum and minimum temperature values were converted into daily averages for modeling purposes. The period of record selected for model runs (April 1, 1993 through March 31, 2001) was based on the availability of recent weather data and corresponding streamflow records. The weather data collected at the NCDC station of Palm 3 SE were used to construct the weather file used in all watershed simulations (both impaired and reference). Figure E-3 shows the location of the weather station used for modeling purposes.

E.3.4 Hydrology Calibration

Daily streamflow data are needed to calibrate watershed hydrology parameters in the GWLF model. There is a continuous USGS flow gage at the mouth of Wissahickon Creek (USGS 0147400 Wissahickon Creek at mouth, Philadelphia, PA) that has flow data from October 1, 1965 through September 30, 2001. There is no flow gage in the reference watershed of Ironworks Creek, so hydrology was calibrated at the nearby Little Neshaminy Creek watershed, which is similar in size as well as other characteristics (i.e., soils, geology, landuse) to Ironworks Creek. The Little Neshaminy gage (USGS 01464907 Little Neshaminy Creek @ Valley Rd near Neshaminy, PA) has flow data from November 25, 1998 through September 30, 2001.

Using the input files created in AVGWLF, the model predicted overall water balances in impaired and reference watersheds. For both Wissahickon Creek and Ironworks Creek, weather data obtained from the NCDC meteorological station located at Palm 3 SE were used to model the chosen time period (April 1, 1993 through March 31, 2001 for Wissahickon Creek and April 1998 through March 2001 for Ironworks Creek). The modeling period is determined based on the availability of weather and flow data that were collected during the same time period. In general, an R^2 value greater than 0.7 indicates a strong, positive correlation between simulated and observed data. The R^2 value for the Wissahickon Creek and ironworks Creek hydrology calibrations were 0.76 and 0.74, respectively. These results indicate a good correlation between simulated and observed results for these watersheds. Hydrology calibration results and the modeled time period for reference watersheds are presented in Figures E-4 and E-5.

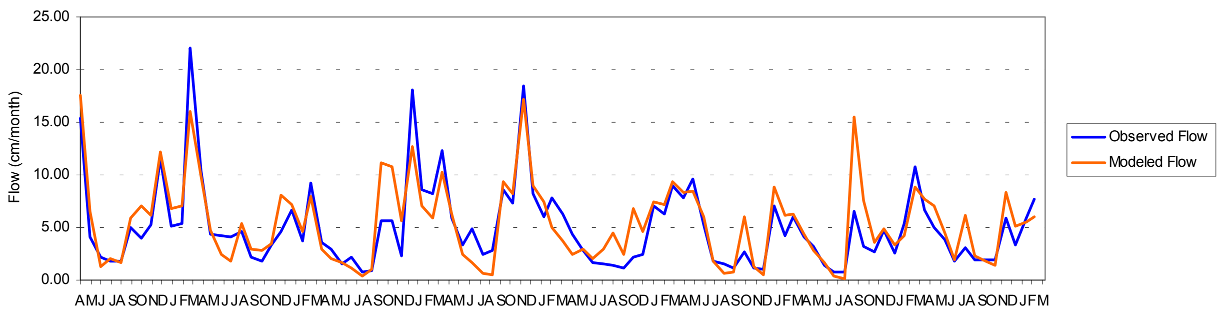

Figure E-4. Hydrology calibration at USGS gage 01474000 (Wissahickon Creek at Mouth, Philadelphia, PA); April 1993 through March 2001

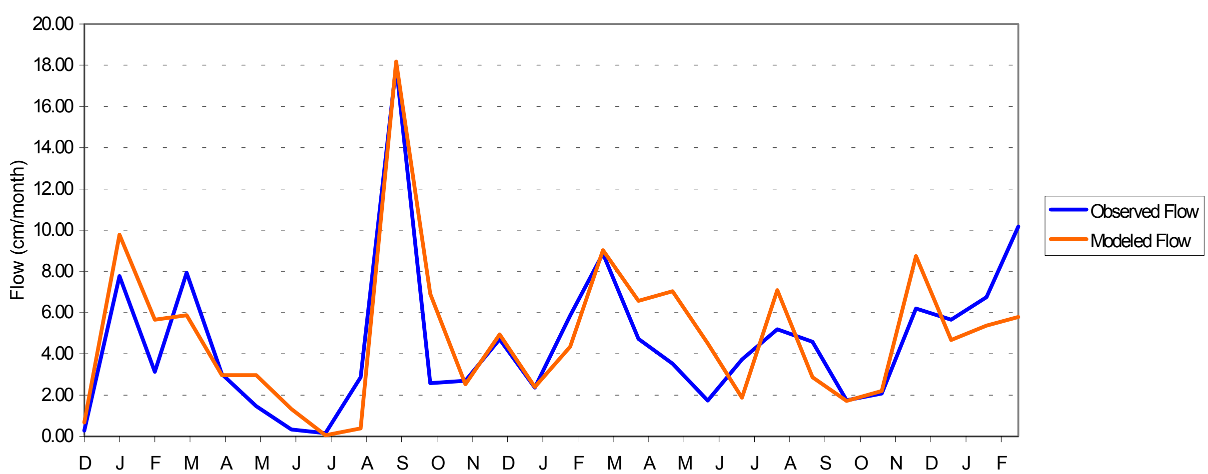

Figure E-5. Calibration for Ironworks Creek using the reference gage at Little Neshaminy Creek (USGS 01464907). December 1998 through March 2001.

E.3.5 Water Quality Calibration

Water quality observations at the same location as USGS gage 01474000 at the mouth of Wissahickon Creek were available (as a concentration) to compare to model output, however, sediment loading rates are predicted by GWLF as monthly loads. The average daily streamflow and monthly TSS concentrations in mg/L were used to determine an estimated monthly sediment load based on linear regression. Based on the comparison of the model output to observed TSS values for the period of January 1994 through December 2000, the Wissahickon Creek watershed's C (vegetation cover) and P (conservation practices) values were adjusted to reflect the high sediment loads observed in the watershed. Observed water quality data were not available for comparison to reference watershed output, therefore the default sediment parameters selected during GWLF setup were used. Based on habitat assessments provided by PADEP for waterbodies in the Wissahickon Creek watershed as well as the Ironworks Creek watershed, the Wissahickon Creek watershed had poorer habitat conditions than Ironworks creek, which supports the increased C and P values used in modeling the Wissahickon Creek watershed. Figure E-6 presents the observed monthly sediment load in Wissahickon Creek (based on the monthly observed concentrations and daily flow values) compared to sediment output from the GWLF model.

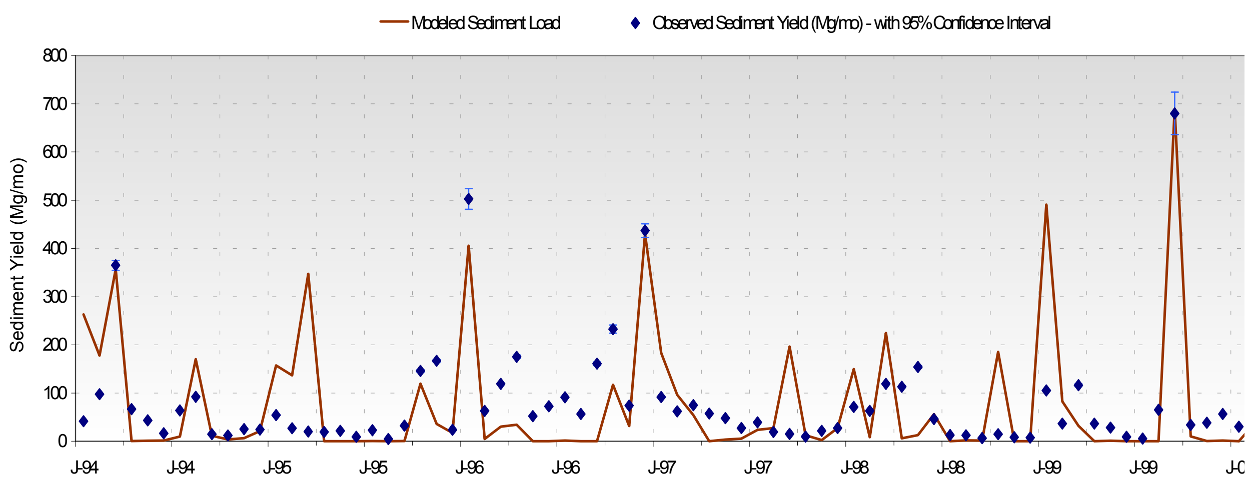

Figure E-6. Observed sediment compared to GWLF modeled sediment loads at USGS 0147400 at the mouth of Wissahickon Creek

Table F-1. TMDL Summary for Trewellyn Creek (Segment 971217-1145-ACE)
Trout Stocking DO Criteria; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	1.922	0.049	0.162	0.029

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
None														
Total Waste Load Allocations							0.000	0.000	0.000	0.000				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
Backgound	0.30	1.19	0.03	0.10	0.02	1.922	0.049	0.162	0.029	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						1.922	0.049	0.162	0.029				

Table F-2. TMDL Summary for Pine Run (Segment 971215-1300-ACE)
Trout Stocking DO Criteria; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	1.181	0.040	0.986	0.100

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
None														
Total Waste Load Allocations							0.000	0.000	0.000	0.000				

Load Allocations

Source/Upstream Stream Segmen	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
Background	0.18	1.20	0.04	1.00	0.10	1.1813	0.0398	0.9855	0.0995	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						1.181	0.040	0.986	0.100				

Table F-3. TMDL Summary for Pine Run (Segment 971215-1303-ACE)
Trout Stocking DO Criteria; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	121.984	10.787	336.649	15.062

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5[A]	NH3-N[A]	NO3+NO2-N[B]	Ortho PO4-P[B]
Upper Dublin Township	PA0029441	1.70	13.21	1.18	36.71	1.64	120.803	10.747	335.664	14.963	11.9%	53.0%	-90.0%	28.8%
Total Waste Load Allocations							120.803	10.747	335.664	14.963				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
Pine Run (971215-1300-ACE)	0.18	1.20	0.04	1.00	0.10	1.181	0.040	0.986	0.100	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						1.181	0.040	0.986	0.100				

A - Calculated from NPDES permit limit
B - Calculated from average of summer 2002 monitoring

Table F-4. TMDL Summary for Sandy Run (Segment 971215-1133-ACE)
Trout Stocking DO Criteria; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	359.259	33.393	1323.087	75.298

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5[A]	NH3-N[A]	NO3+NO2-N[B]	Ortho PO4-P[B]
Abington Township	PA0026867	6.05	7.50	0.72	30.27	1.85	243.979	23.433	984.961	60.291	25.0%	64.0%	0.0%	60.0%
Valley Green Corporate Center	PA0053074	0.013	10.04	1.97	18.78	3.13	0.705	0.139	1.320	0.220	0.0%	0.0%	0.0%	0.0%
Total Waste Load Allocations							244.684	23.571	986.281	60.511				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
Background	0.11	2.94	0.07	1.98	0.20	1.675	0.040	1.130	0.113	0.0%	0.0%	0.0%	0.0%
Pine Run (971215-1303-ACE)	1.87	11.21	0.97	33.32	1.46	112.899	9.782	335.677	14.674	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						114.575	9.822	336.806	14.787				

A - Calculated from NPDES permit limit
B - Calculated from average of summer 2002 monitoring

Table F-5. TMDL Summary for Lorraine Run (Segment 971215-1000-ACE)
Trout Stocking DO Criteria; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	123.850	1.366	134.532	1.955

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5[A]	TMDL Percent Reduction NH3-N[A]	TMDL Percent Reduction NO3+NO2-N[B]	TMDL Percent Reduction Ortho PO4-P[B]
Sayers, David & Marie	PA0057631	0.0008	9.99	2.24	4.98	0.52	0.042	0.010	0.021	0.002	0.0%	0.0%	0.0%	0.0%
Murray SRSTP	PA0053210	0.0008	9.90	0.52	0.99	0.52	0.042	0.002	0.004	0.002	0.0%	0.0%	0.0%	0.0%
Harris, Albert & Cynthia	PA0051012	0.0006	10.04	2.98	8.00	0.53	0.034	0.010	0.027	0.002	0.0%	0.0%	0.0%	0.0%
Total Waste Load Allocations							0.118	0.022	0.052	0.006				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	TMDL Percent Reduction NH3-N	TMDL Percent Reduction NO3+NO2-N	TMDL Percent Reduction Ortho PO4-P
Coorson's Quarry	12.50	1.84	0.02	2.00	0.03	123.732	1.344	134.480	1.949	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						123.732	1.344	134.480	1.949				

A - Calculated from NPDES permit limit
B - Calculated from average of summer 2002 monitoring

Table F-6. TMDL Summary for Wissahickon Creek (Segment 971218-1345-ACE)
Trout Stocking DO Criteria; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	258.753	38.509	1058.378	97.398

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5[A]	TMDL Percent Reduction NH3-N[A]	TMDL Percent Reduction NO3+NO2-N[B]	TMDL Percent Reduction Ortho PO4-P[B]
North Wales Boro	PA0022586	1.29	3.00	0.50	15.16	1.41	20.828	3.470	105.160	9.771	70.0%	80.0%	0.0%	70.0%
Upper Gwynedd Townshi	PA0023256	8.82	5.00	0.74	20.08	1.82	237.196	35.010	952.755	86.408	50.0%	59.0%	-38.0%	49.0%
Bruce K. Entwisle	PA0057576	0.001	9.92	2.97	1.00	0.49	0.059	0.018	0.006	0.003	0.0%	0.0%	0.0%	0.0%
Merck & Company, Inc.	PA0053538	0.10	1.26	0.02	0.86	2.28	0.670	0.011	0.457	1.215	0.0%	0.0%	0.0%	0.0%
Total Waste Load Allocations							258.753	38.509	1058.378	97.398				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	TMDL Percent Reduction NH3-N	TMDL Percent Reduction NO3+NO2-N	TMDL Percent Reduction Ortho PO4-P
Backgound assumed as release from Merck & Company, Inc. and received a WLA													
Total Load Allocations						0.000	0.000	0.000	0.000				

A - Calculated from NPDES permit limit
B - Calculated from average of summer 2002 monitoring

Table F-7. TMDL Summary for Wissahickon Creek (Segment 971222-1130-ACE)
Trout Stocking DO Criteria; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	222.733	33.223	1050.113	95.465

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
None														
Total Waste Load Allocations							0.000	0.000	0.000	0.000				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
Wissahickon Creek (971218-1345-ACE)	10.19	4.04	0.61	19.15	1.74	221.275	33.174	1049.951	95.449	0.0%	0.0%	0.0%	0.0%
Trewellyn Creek (971217-1145-ACE)	0.30	0.90	0.03	0.10	0.01	1.458	0.049	0.162	0.016	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						222.733	33.223	1050.113	95.465				

Table F-8. TMDL Summary for Wissahickon Creek (Segment 971209-1430-ACE)
Trout Stocking DO Criteria; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	835.590	93.169	4064.599	404.039

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
None														
Total Waste Load Allocations							0.000	0.000	0.000	0.000				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
Wissahickon Creek (971209-0930-ACE	41.61	3.68	0.41	18.16	1.80	824.370	92.512	4063.995	403.743	0.0%	0.0%	0.0%	0.0%
Background	1.70	1.23	0.07	0.07	0.03	11.220	0.657	0.604	0.296	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						835.590	93.169	4064.599	404.039				

Table F-9. TMDL Summary for Wissahickon Creek (Segment 971209-0930-ACE)
Trout Stocking DO Criteria; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	1063.315	122.485	4120.863	415.299

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5[A]	NH3-N[A]	NO3+NO2-N[B]	Ortho PO4-P[B]
Ambler Borough Water Department	PA0052515	0.027	5.30	0.11	0.21	0.28	0.763	0.015	0.031	0.040	0.0%	0.0%	0.0%	0.0%
PA Historical & Museum Commission	PA0055387	0.002	24.98	20.00	30.13	0.52	0.212	0.169	0.255	0.004	0.0%	0.0%	0.0%	0.0%
Fishbone, David	PA0054577	0.001	9.99	2.97	5.94	0.37	0.059	0.018	0.035	0.002	0.0%	0.0%	0.0%	0.0%
Total Waste Load Allocations							1.034	0.202	0.321	0.046				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
Wissahickon Creek (971222-0930-ACE	20.53	6.02	0.87	24.27	3.10	664.184	96.606	2679.987	342.270	0.0%	0.0%	0.0%	0.0%
Sandy Run (971215-1133-ACE)	8.00	6.57	0.57	30.36	1.67	282.675	24.311	1306.136	71.667	0.0%	0.0%	0.0%	0.0%
Lorraine Run (971215-1000-ACE)	12.51	1.72	0.02	2.00	0.02	115.422	1.366	134.419	1.315	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						1062.281	122.283	4120.542	415.253				

A - Calculated from NPDES permit limit
B - Calculated from average of summer 2002 monitoring

Table F-10. TMDL Summary for Wissahickon Creek (Segment 971222-0930-ACE)
Trout Stocking DO Criteria; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	702.766	101.491	2691.394	344.789

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5[A]	NH3-N[A]	NO3+NO2-N[B]	Ortho PO4-P[B]
Ambler Boro	PA0026603	10.10	10.00	1.50	30.52	4.68	543.402	81.466	1657.755	254.221	0.0%	0.0%	-51.1%	0.0%
Total Waste Load Allocations							543.402	81.466	1657.755	254.221				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
Wissahickon Creek (971222-1130-ACE	10.45	2.84	0.36	18.39	1.61	159.364	20.025	1033.639	90.568	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						159.364	20.025	1033.639	90.568				

A - Calculated from NPDES permit limit
B - Calculated from average of summer 2002 monitoring

Table F-11. TMDL Summary for Trewellyn Creek (Segment 971217-1145-ACE)
Warm Water Fish; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	1.922	0.049	0.162	0.029

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
None														
Total Waste Load Allocations							0.000	0.000	0.000	0.000				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
Backgound	0.30	1.19	0.03	0.10	0.02	1.922	0.049	0.162	0.029	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						1.922	0.049	0.162	0.029				

Table F-12. TMDL Summary for Pine Run (Segment 971215-1300-ACE)
Warm Water Fish; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	1.181	0.040	0.986	0.100

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
None														
Total Waste Load Allocations							0.000	0.000	0.000	0.000				

Load Allocations

Source/Upstream Stream Segmen	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
Background	0.18	1.20	0.04	1.00	0.10	1.181	0.040	0.986	0.100	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						1.181	0.040	0.986	0.100				

Table F-13. TMDL Summary for Pine Run (Segment 971215-1303-ACE)
Warm Water Fish; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	138.501	22.907	301.293	21.161

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5[A]	TMDL Percent Reduction NH3-N[A]	TMDL Percent Reduction NO3+NO2-N[B]	TMDL Percent Reduction Ortho PO4-P[B]
Upper Dublin Township	PA0029441	1.70	15.00	2.50	32.85	2.30	137.319	22.868	300.307	21.062	0.0%	0.0%	-70.0%	0.0%
Total Waste Load Allocations							137.319	22.868	300.307	21.062				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	TMDL Percent Reduction NH3-N	TMDL Percent Reduction NO3+NO2-N	TMDL Percent Reduction Ortho PO4-P
Pine Run (971215-1300-ACE)	0.18	1.20	0.04	1.00	0.10	1.181	0.040	0.986	0.100	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						1.181	0.040	0.986	0.100				

A - Calculated from NPDES permit limit
B - Calculated from average of summer 2002 monitoring

Table F-14. TMDL Summary for Sandy Run (Segment 971215-1133-ACE)
Warm Water Fish; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	456.179	86.835	1288.134	171.741

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5[A]	TMDL Percent Reduction NH3-N[A]	TMDL Percent Reduction NO3+NO2-N[B]	TMDL Percent Reduction Ortho PO4-P[B]
Abington Township	PA0026867	6.05	10.00	2.00	30.27	4.63	325.439	65.097	984.961	150.715	0.0%	0.0%	0.0%	0.0%
Valley Green Corporate Center	PA0053074	0.013	10.04	1.97	18.78	3.13	0.705	0.139	1.320	0.220	0.0%	0.0%	0.0%	0.0%
Total Waste Load Allocations							326.145	65.235	986.281	150.935				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	TMDL Percent Reduction NH3-N	TMDL Percent Reduction NO3+NO2-N	TMDL Percent Reduction Ortho PO4-P
Background	0.11	2.94	0.07	1.98	0.20	1.675	0.040	1.130	0.113	0.0%	0.0%	0.0%	0.0%
Pine Run (971215-1303-ACE)	1.87	12.74	2.14	29.85	2.05	128.358	21.560	300.724	20.692	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						130.034	21.600	301.853	20.805				

Table F-15. TMDL Summary for Lorraine Run (Segment 971215-1000-ACE)
Warm Water Fish; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	123.850	1.366	134.532	1.955

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5[A]	NH3-N[A]	NO3+NO2-N[B]	Ortho PO4-P[B]
Sayers, David & Marie	PA0057631	0.0008	9.99	2.24	4.98	0.52	0.042	0.010	0.021	0.002	0.0%	0.0%	0.0%	0.0%
Murray SRSTP	PA0053210	0.0008	9.90	0.52	0.99	0.52	0.042	0.002	0.004	0.002	0.0%	0.0%	0.0%	0.0%
Harris, Albert & Cynthia	PA0051012	0.0006	10.04	2.98	8.00	0.53	0.034	0.010	0.027	0.002	0.0%	0.0%	0.0%	0.0%
Total Waste Load Allocations							0.118	0.022	0.052	0.006				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
Coorson's Quarry	12.50	1.84	0.02	2.00	0.03	123.732	1.344	134.480	1.949	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						123.732	1.344	134.480	1.949				

Table F-16. TMDL Summary for Wissahickon Creek (Segment 971218-1345-ACE)
Warm Water Fish; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	445.052	86.405	1051.573	170.411

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5[A]	NH3-N[A]	NO3+NO2-N[B]	Ortho PO4-P[B]
North Wales Boro	PA0022586	1.29	5.90	1.37	21.22	2.40	40.940	9.540	147.201	16.619	41.0%	45.0%	-40.0%	49.0%
Upper Gwynedd Townshi	PA0023256	8.82	8.50	1.62	19.05	3.22	403.383	76.837	903.908	152.574	15.0%	10.0%	-30.9%	9.9%
Bruce K. Entwisle	PA0057576	0.001	9.92	2.97	1.00	0.49	0.059	0.018	0.006	0.003	0.0%	0.0%	0.0%	0.0%
Merck & Company, Inc.	PA0053538	0.10	1.26	0.02	0.86	2.28	0.670	0.011	0.457	1.215	0.0%	0.0%	0.0%	0.0%
Total Waste Load Allocations							445.052	86.405	1051.573	170.411				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
Backgound assumed as release from Merck & Company, Inc. and received a WLA													
Total Load Allocations						0.000	0.000	0.000	0.000				

A - Calculated from NPDES permit limit
B - Calculated from average of summer 2002 monitoring

Table F-17. TMDL Summary for Wissahickon Creek (Segment 971222-1130-ACE)
Warm Water Fish; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	383.300	77.696	1045.820	167.137

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	TMDL Percent Reduction NH3-N	TMDL Percent Reduction NO3+NO2-N	TMDL Percent Reduction Ortho PO4-P
None														
Total Waste Load Allocations							0.000	0.000	0.000	0.000				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	TMDL Percent Reduction NH3-N	TMDL Percent Reduction NO3+NO2-N	TMDL Percent Reduction Ortho PO4-P
Wissahickon Creek (971218-1345-ACE)	10.19	6.97	1.42	19.07	3.05	381.841	77.647	1045.658	167.121	0.0%	0.0%	0.0%	0.0%
Trewellyn Creek (971217-1145-ACE)	0.30	0.90	0.03	0.10	0.01	1.458	0.049	0.162	0.016	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						383.300	77.696	1045.820	167.137				

Table F-18. TMDL Summary for Wissahickon Creek (Segment 971209-1430-ACE)
Warm Water Fish; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	973.035	167.356	4031.623	559.839

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	TMDL Percent Reduction NH3-N	TMDL Percent Reduction NO3+NO2-N	TMDL Percent Reduction Ortho PO4-P
None														
Total Waste Load Allocations							0.000	0.000	0.000	0.000				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	TMDL Percent Reduction NH3-N	TMDL Percent Reduction NO3+NO2-N	TMDL Percent Reduction Ortho PO4-P
Wissahickon Creek (971209-0930-ACE	41.61	4.30	0.74	18.01	2.50	961.815	166.699	4031.019	559.543	0.0%	0.0%	0.0%	0.0%
Background	1.70	1.23	0.07	0.07	0.03	11.220	0.657	0.604	0.296	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						973.035	167.356	4031.623	559.839				

Table F-19. TMDL Summary for Wissahickon Creek (Segment 971209-0930-ACE)
Warm Water Fish; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	1241.005	206.392	4080.346	575.398

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5[A]	NH3-N[A]	NO3+NO2-N[B]	Ortho PO4-P[B]
Ambler Borough Water Department	PA0052515	0.027	5.30	0.11	0.21	0.28	0.763	0.015	0.031	0.040	0.0%	0.0%	0.0%	0.0%
PA Historical & Museum Commission	PA0055387	0.002	24.98	20.00	30.13	0.52	0.212	0.169	0.255	0.004	0.0%	0.0%	0.0%	0.0%
Fishbone, David	PA0054577	0.001	9.99	2.97	5.94	0.37	0.059	0.018	0.035	0.002	0.0%	0.0%	0.0%	0.0%
Total Waste Load Allocations							1.034	0.202	0.321	0.046				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
Wissahickon Creek (971222-0930-ACE	20.53	6.94	1.20	24.18	3.71	766.495	132.607	2670.026	409.898	0.0%	0.0%	0.0%	0.0%
Sandy Run (971215-1133-ACE)	8.00	8.32	1.68	29.65	3.82	358.055	72.217	1275.580	164.139	0.0%	0.0%	0.0%	0.0%
Lorraine Run (971215-1000-ACE)	12.51	1.72	0.02	2.00	0.02	115.422	1.366	134.419	1.315	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						1239.972	206.190	4080.025	575.352				

A - Calculated from NPDES permit limit
B - Calculated from average of summer 2002 monitoring

Table F-20. TMDL Summary for Wissahickon Creek (Segment 971222-0930-ACE)
Warm Water Fish; Major Discharge DO = 7.0 mg/L

	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)
TMDL =	822.163	140.176	2679.794	413.656

Waste Load Allocations

Name	NPDES	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5[A]	NH3-N[A]	NO3+NO2-N[B]	Ortho PO4-P[B]
Ambler Boro	PA0026603	10.10	10.00	1.50	30.31	4.68	543.402	81.466	1646.820	254.221	0.0%	0.0%	-50.1%	0.0%
Total Waste Load Allocations							543.402	81.466	1646.820	254.221				

Load Allocations

Source/Upstream Stream Segment	Flow (cfs)	CBOD5 (mg/L)	NH3-N (mg/L)	NO3+NO2-N (mg/L)	Ortho PO4-P (mg/L)	CBOD5 (lbs/day)	NH3-N (lbs/day)	NO3+NO2-N (lbs/day)	Ortho PO4-P (lbs/day)	TMDL Percent Reduction CBOD5	NH3-N	NO3+NO2-N	Ortho PO4-P
Wissahickon Creek (971222-1130-ACE	10.45	4.96	1.04	18.38	2.84	278.761	58.710	1032.974	159.435	0.0%	0.0%	0.0%	0.0%
Total Load Allocations						278.761	58.710	1032.974	159.435				

A - Calculated from NPDES permit limit
B - Calculated from average of summer 2002 monitoring

Table G-1. Sediment TMDL at the mouth of subwatershed 1 (including listed segments 971217-1430-ACE, 971218-1045-ACE, 971218-1345-ACE, and 981015-1100-ACE)

TMDL (lbs/year)	MOS (lbs/yr)	WLA (lbs/yr)*	LA (lbs/yr)
1,935,056.33	193,505.63	1,741,550.69	0.00

* The WLA includes the collective load from point sources at the mouth of subwatershed 1 after the sediment delivery ratio of 0.18 was applied to account for transport losses

Table G-2. Wasteload allocations for streambank erosion in Segment 971217-1430-ACE in subwatershed 1

Township (MS4)	Average Annual Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Lower Gwynedd	22,477.38	13,318.26	40.7
Stream Bank Erosion Montgomery	1,236.62	732.72	40.7
Stream Bank Erosion North Wales	16,803.48	9,956.37	40.7
Stream Bank Erosion Upper Gwynedd	310,900.73	184,214.41	40.7
Stream Bank Erosion Worcester	6,255.84	3,706.70	40.7
Total Streambank Wasteload Allocations		**211,928.47**	

Table G-3. Wasteload allocations for overland load in Segment 971217-1430-ACE in subwatershed 1

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
LOWER GWYNEDD	NA	NA	7,389.53	4,497.91	39.1
MONTGOMERY	NA	NA	741.08	535.77	27.7
NORTH WALES	NA	NA	7,469.23	3,925.42	47.4
UPPER GWYNEDD	NA	NA	119,513.95	91,615.33	23.3
WORCESTER	NA	NA	2,536.80	1,892.28	25.4
Total Overland Wasteload Allocations				**102,466.71**	

Table G-4. Wasteload allocations for streambank erosion in Segment 971218-1045-ACE in subwatershed 1

Township (MS4)	Average Annual Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Lansdale	142,653.79	84,525.00	40.7
Stream Bank Erosion Montgomery	128,658.12	76,232.30	40.7
Stream Bank Erosion North Wales	7,435.20	4,405.49	40.7
Stream Bank Erosion Upper Gwynedd	355,431.71	210,599.84	40.7
Total Streambank Wasteload Allocations		**375,762.63**	

Table G-5. Wasteload allocations for overland load in Segment 971218-1045-ACE in subwatershed 1

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
LANSDALE	NA	NA	59,405.11	33,980.98	42.8
MONTGOMERY	NA	NA	46,135.80	28,014.75	39.3
NORTH WALES	NA	NA	3,228.73	1,696.46	47.5
UPPER GWYNEDD	NA	NA	148,147.25	101,551.19	31.5
Total Overland Wasteload Allocations				**165,243.38**	

Table G-6. Wasteload allocations for streambank erosion in Segment 971218-1345-ACE in subwatershed 1

Township (MS4)	Average Annual Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Lower Gwynedd	211,107.58	125,085.13	40.7
Stream Bank Erosion Montgomery	72.95	43.22	40.7
Stream Bank Erosion North Wales	74,259.68	44,000.23	40.7
Stream Bank Erosion Upper Gwynedd	238,316.68	141,207.02	40.7
Stream Bank Erosion Whitpain	77,542.28	45,945.23	40.7
Stream Bank Erosion Worcester	14,151.65	8,385.11	40.7
Total Streambank Wasteload Allocations		**364,665.95**	

Table G-7. Wasteload allocations for overland load in Segment 971218-1345-ACE in subwatershed 1

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
PA0022586 North Wales Boro	1.29	30	13,734.74	13,734.74	0.0
PA0023256 Upper Gwynedd Township	8.82	30	93,758.14	93,758.14	0.0
PA0057576 Single Family Residence STP	0.001	20	7.68	7.68	0.0
LOWER GWYNEDD	NA	NA	51,863.42	43183.42	16.7
MONTGOMERY	NA	NA	30.98	16.20	47.7
NORTH WALES	NA	NA	30,480.81	16271.54	46.6
UPPER GWYNEDD	NA	NA	108,377.71	78444.89	27.6
WHITPAIN	NA	NA	48,349.46	36774.61	23.9
WORCESTER	NA	NA	8,108.04	6746.44	16.8
Total Overland Wasteload Allocations				**288,937.66**	

Table G-8. Wasteload allocations for streambank erosion in Segment 981015-1100-ACE in subwatershed 1

Township (MS4)	Average Annual Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Lansdale	1,216.00	720.50	40.7
Stream Bank Erosion Montgomery	102,215.69	60,564.68	40.7
Stream Bank Erosion North Wales	22,174.15	13,138.59	40.7
Stream Bank Erosion Upper Gwynedd	137,265.16	81,332.14	40.7
Total Streambank Wasteload Allocations		**155,755.91**	

Table G-9. Wasteload allocations for overland load in Segment 981015-1100-ACE in subwatershed 1

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
LANSDALE	NA	NA	890.86	761.93	14.5
MONTGOMERY	NA	NA	51,155.12	35,951.17	29.7
NORTH WALES	NA	NA	8,891.83	4,690.10	47.3
UPPER GWYNEDD	NA	NA	52,495.24	35,386.79	32.6

Total Overland Wasteload Allocations	**76,789.99**	

SUBWATERSHED 2

Table G-10. Sediment TMDL at the mouth of subwatershed 2 (including listed segments 971216-1415-ACE, 971217-1015-ACE, 971217-1145-ACE, 971222-0930-ACE, and 971222-1130-ACE)

TMDL (lbs/year)	WLA (lbs/year)	LA (lbs/year)	MOS (lbs/year)
7,436,463.38	6,402,558.59	290,258.45	743,646.34

*The WLA includes the collective load from the point sources at the mouth of subwatershed 2 after the sediment deliver ratio of 0.15 was applied to account for transport losses

Table G-11. Wasteload allocations for streambank erosion in Segment 971216-1415-ACE in subwatershed 2

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Ambler	294,179.83	161,399.48	45.1
Stream Bank Erosion Lower Gwynedd	414,906.55	227,635.26	45.1
Stream Bank Erosion Upper Dublin	1,837,891.63	1,008,344.99	45.1
Stream Bank Erosion Whitpain	18,412.39	10,101.82	45.1
Total Streambank Wasteload Allocations		**1,407,481.55**	

Table G-12. Wasteload allocations for overland load in Segment 971216-1415-ACE in subwatershed 2

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
PA0026603 Ambler Boro	10.06	30	89,097.64	89,097.64	0.0
AMBLER	NA	NA	43,498.58	11,323.89	74.0
LOWER GWYNEDD	NA	NA	43,230.19	17,330.75	59.9
UPPER DUBLIN	NA	NA	228,481.81	97,687.14	57.2
WHITPAIN	NA	NA	3,129.69	2,052.25	34.4
Total Overland Wasteload Allocations				**217,491.67**	

Table G-13. Wasteload allocations for streambank erosion in Segment 971217-1015-ACE in subwatershed 2

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Lower Gwynedd	1,598,812.39	877,176.02	45.1
Stream Bank Erosion Whitpain	32,513.24	17,838.14	45.1
Total Streambank Wasteload Allocations		**895,014.16**	

Table G-14. Wasteload allocations for overland load in Segment 971217-1015-ACE in subwatershed 2

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction

LOWER GWYNEDD	NA	NA	205,686.80	10,2997.66	49.9
WHITPAIN	NA	NA	1,890.83	1,089.96	42.4
Total Overland Wasteload Allocations				**104,087.62**	

Table G-15. Wasteload allocations for streambank erosion in Segment 971217-1145-ACE in subwatershed 2

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Horsham	60,666.17	33,284.02	45.14
Stream Bank Erosion Lower Gwynedd	1,768,135.41	970,073.78	45.14
Stream Bank Erosion Montgomery	261,977.09	143,731.70	45.14
Stream Bank Erosion Upper Gwynedd	10,076.04	5,528.14	45.14
Total Streambank Wasteload Allocations		**1,152,617.64**	

Table G-16. Wasteload allocations for overland load in Segment 971217-1145-ACE in subwatershed 2

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
HORSHAM	NA	NA	4,441.70	1,249.45	71.9
LOWER GWYNEDD	NA	NA	221,631.92	89,049.14	59.8
MONTGOMERY	NA	NA	37,314.21	11,038.32	70.4
UPPER GWYNEDD	NA	NA	1,859.90	566.34	69.5
Total Overland Wasteload Allocations				**101,903.24**	

Table G-17. Wasteload allocations for streambank erosion in Segment 971222-0930-ACE in subwatershed 2

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Ambler	208,772.01	114,541.14	45.1
Stream Bank Erosion Upper Dublin	290,356.26	159,301.71	45.1
Stream Bank Erosion Whitemarsh	421,100.25	231,033.38	45.1
Stream Bank Erosion Whitpain	1,499,685.88	822,791.03	45.1
Total Streambank Wasteload Allocations		**1,327,667.26**	

Table G-18. Wasteload allocations for overland load in Segment 971222-0930-ACE in subwatershed2

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
AMBLER	NA	NA	30,238.40	8,551.23	71.7
UPPER DUBLIN	NA	NA	18,839.31	7,461.86	60.4
WHITEMARSH	NA	NA	28,740.87	19,041.52	33.7
WHITPAIN	NA	NA	206,639.52	109,195.27	47.2
Total Overland Wasteload Allocations				**144,249.88**	

Table G-19. Wasteload allocations for streambank erosion in Segment 971222-1130-ACE in subwatershed 2

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Ambler	7,993.80	4,385.74	45.1

Stream Bank Erosion Lower Gwynedd	537,688.36	294,998.55	45.1
Stream Bank Erosion Montgomery	1,051.82	577.07	45.1
Stream Bank Erosion Upper Gwynedd	210.36	115.41	45.1
Stream Bank Erosion Whitpain	1,244,508.74	682,790.07	45.1
Total Streambank Wasteload Allocations		**982,866.84**	

Table G-20. Wasteload allocations for overland load in Segment 971222-1130-ACE in subwatershed 2

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
AMBLER	NA	NA	1,271.52	420.67	66.9
LOWER GWYNEDD	NA	NA	45,708.78	21,841.92	52.2
MONTGOMERY	NA	NA	173.07	43.27	75.0
UPPER GWYNEDD	NA	NA	38.52	9.63	75.0
WHITPAIN			82,482.51	46,863.25	43.2
Total Overland Wasteload Allocations				**69,178.74**	

Table G-21. Sediment load from contributing upstream watersheds (subwatershed 1)

Contributing Watersheds (loads subject to estimated sediment delivery ratio)	Annual Average Load (lbs/year)	Sediment Delivery Ratio	Load Delivered from Stream (lbs/year)	LA (avg. annual) (lbs/year)	% Reduction
Subwatershed 1	1,935,056.33	0.15	290,258.45	290,258.45	0.0
Total Load Allocations				**290,258.45**	

SUBWATERSHED 3

Table G-22. Sediment TMDL at the mouth of subwatershed 3 (including 971215-1133-ACE, 971215-1300-ACE, and 971215-1303-ACE)

TMDL (lbs/year)	WLA (lbs/year)*	LA (lbs/year)	MOS (lbs/year)
4,103,922.73	3,693,530.45	0.00	410,392.27

*The WLA includes the collective load from the point sources at the mouth of subwatershed 3 after the sediment delivery ratio of 0.17 was applied to account for transport losses

Table G-23. Wasteload allocations for streambank erosion in Segment 971215-1133-ACE in subwatershed 3

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Abington	1,317,006.08	900,146.90	31.7
Stream Bank Erosion Springfield	118,481.87	80,979.95	31.7
Stream Bank Erosion Upper Dublin	732,025.84	500,324.80	31.7
Stream Bank Erosion Upper Moreland	8,069.58	5,515.39	31.7
Stream Bank Erosion Whitemarsh	242,855.82	165,987.02	31.7
Total Streambank Wasteload Allocations		**1,652,954.07**	

Table G-24. Wasteoad allocations for overland load in Segment 971215-1133-ACE in subwatershed 3

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
PA0053074 Valley Green Corporate Center	0.01	30	128.94	128.94	0.0
PA0026867 Abington Township	6.05	30	60,741.75	60,741.75	0.0
ABINGTON	NA	NA	322,843.59	94,968.38	70.58
SPRINGFIELD	NA	NA	20,485.97	11,293.00	44.87
UPPER DUBLIN	NA	NA	148,090.18	53,544.19	63.84
UPPER MORELAND	NA	NA	594.75	208.89	64.88
WHITEMARSH	NA	NA	51,578.67	29,374.62	43.05
Total Overland Wasteload Allocations				**250,259.76**	

Table G-25. Wasteload allocations for streambank erosion in Segment 971215-1300-ACE in subwatershed 3

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Abington	769.13	525.69	31.7
Stream Bank Erosion Horsham	2,179.20	1,489.44	31.7
Stream Bank Erosion Upper Dublin	1,362,130.03	930,988.21	31.7
Stream Bank Erosion Upper Moreland	4,102.03	2,803.65	31.7
Total Streambank Wasteload Allocations		**935,806.99**	

Table G-26. Wasteoad allocations for overland load in Segment 971215-1300-ACE in subwatershed 3

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
ABINGTON	NA	NA	240.87	62.78	73.94
HORSHAM	NA	NA	504.37	147.34	70.79

UPPER DUBLIN	NA	NA	288,873.69	119,953.28	58.48
UPPER MORELAND	NA	NA	706.60	357.63	49.39
Total Overland Wasteload Allocations				**120,521.03**	

Table G-27. Wasteload allocations for streambank erosion in Segment 971215-1303-ACE in subwatershed 3

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Horsham	3,070.86	2,098.87	31.7
Stream Bank Erosion Upper Dublin	920,746.40	629,311.47	31.7
Stream Bank Erosion Whitemarsh	7,549.20	5,159.72	31.7
Total Streambank Wasteload Allocations		**636,570.06**	

Table G-28. Wasteload allocations for overland load Segment 971215-1303-ACE in subwatershed 3

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
PA0029441 Upper Dublin Township	1.70	30	17,088.47	17,088.47	0.0
HORSHAM	NA	NA	818.36	264.87	67.63
UPPER DUBLIN	NA	NA	178,810.55	79,130.14	55.75
WHITEMARSH	NA	NA	1,083.81	935.07	13.72
Total Overland WastelLoad Allocations				**97,418.55**	

SUBWATERSHED 4

Table G-29. TMDL for subwatershed 4 (including listed segments 971208-1000-ACE, 971209-0930-ACE, 971211-1300-ACE, 971215-1000-ACE, and 971215-1130-ACE)

TMDL (lbs/year)	WLA (lbs/year)	LA (lbs/year)	MOS (lbs/year)
6,338,634.32	3,742,905.24	1,961,865.64	633,863.43

*The WLA includes the collective load from the point sources at the mouth of subwatershed 4 after the sediment delivery ratio of 0.17 was applied to account for transport losses

Table G-30. Wasteload allocations for streambank erosion in Segment 971208-1000-ACE in subwatershed 4

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Philadelphia	550,155.07	81,669.64	85.16
Stream Bank Erosion Springfield	131,534.29	19,526.06	85.16
Stream Bank Erosion Whitemarsh	107,516.39	15,960.64	85.16
Total Streambank Wasteload Allocations		**117,156.34**	

Table G-31. Wasteload allocations for overland load in Segment 971208-1000-ACE in subwatershed 4

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
SPRINGFIELD	NA	NA	11,673.78	9,051.90	22.5
WHITEMARSH	NA	NA	10,785.84	7,878.74	27.0
PHILADELPHIA	NA	NA	681.79	547.70	19.7
Total Overland Wasteload Allocations				**17,478.34**	

Table G-32. Wasteload allocations for streambank erosion in Segment 971209-0930-ACE in subwatershed 4

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Philadelphia	1,005,884.38	149,321.93	85.16
Stream Bank Erosion Springfield	1,153,641.40	171,256.23	85.16
Stream Bank Erosion Upper Dublin	203,553.39	30,217.18	85.16
Stream Bank Erosion Upper Moreland	516.63	76.69	85.16
Stream Bank Erosion Whitemarsh	6,937,864.04	1,029,914.85	85.16
Stream Bank Erosion Whitpain	14,465.72	2,147.41	85.16
Total Streambank Wasteload Allocations		**1,382,934.29**	

Table G-33. Wasteload allocations for overland load in Segment 971209-0930-ACE in subwatershed 4

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load	WLA (avg. annual)	% Reduction

			(lbs/year)	(lbs/year)	
PA0052515 Ambler Borough Water Department	0.026	30	260.99	260.99	0.0
PA0054577 Single Family Residence STP	0.001	10	3.62	3.62	0.0
PA0055387 Pennsylvania Historical & Museum Commission	0.002	30	15.53	15.53	0.0
PHILADELPHIA	NA	NA	41,747.44	11,150.34	73.3
SPRINGFIELD	NA	NA	71,283.21	28,638.54	59.8
UPPER DUBLIN	NA	NA	15,784.23	3,417.34	78.3
UPPER MORELAND	NA	NA	1.93	1.93	0.0
WHITEMARSH	NA	NA	369,947.77	175,898.44	52.5
WHITPAIN	NA	NA	904.90	213.79	76.4
Total Overland Wasteload Allocations				**219,600.53**	

Table G-34. Wasteload allocations for streambank erosion in Segment 971211-1300-ACE in subwatershed 4

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Cheltenham	112,677.09	16,726.73	85.16
Stream Bank Erosion Philadelphia	221,200.19	32,836.81	85.16
Stream Bank Erosion Springfield	3,271,270.38	485,614.87	85.16
Total Streambank Wasteload Allocations		**535,178.42**	

Table G-35. Wasteload allocations for overland load in Segment 971211-1300-ACE in subwatershed 4

NPDES/Township	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
CHELTENHAM	NA	NA	6,470.29	1,437.62	77.8
PHILADELPHIA	NA	NA	14,142.99	4,935.20	65.1
SPRINGFIELD	NA	NA	232,477.57	57,489.40	75.3
Total Overland Wasteload Allocations				**63,862.23**	

Table G-36. Wasteload allocations for streambank erosion in Segment 971215-1000-ACE in subwatershed 4

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Whitemarsh	2,617,096.41	388,503.79	85.16
Stream Bank Erosion Whitpain	297,451.84	44,156.25	85.16
Total Streambank Wasteload Allocations		**432,660.04**	

Table G-37. Wasteload allocations for overland load in Segment 971215-1000-ACE in subwatershed 4

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
PA0051012	0.001	10	2.07	2.07	0.0

Single Family Residence STP					
PA0057631 Single Family Residence STP	0.001	20	5.18	5.18	0.0
PA0053210 Single Family Residence STP	0.001	20	5.18	5.18	0.0
PA0012904 Highway Materials, Inc.	12.378	35	144,993.09	144,993.09	0.0
WHITEMARSH	NA	NA	73,191.25	40,913.66	44.1
WHITPAIN	NA	NA	14,379.55	3,874.78	73.1
Total Overland Wasteload Allocations				**189,793.96**	

Table G-38. Wasteload allocations for streambank erosion in Segment 971215-1130-ACE in subwatershed 4

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Abington	443,916.34	65,898.67	85.2
Stream Bank Erosion Cheltenham	306,328.24	45,473.94	85.2
Stream Bank Erosion Springfield	3,614,673.20	536,592.47	85.2
Stream Bank Erosion Upper Dublin	291,271.43	43,238.78	85.2
Stream Bank Erosion Whitemarsh	44,651.23	6,628.40	85.2
Total Streambank Wasteload Allocations		**697,832.26**	

Table G-39. Wasteload allocations for overland load in Segment 971215-1130-ACE in subwatershed 4

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
ABINGTON	NA	NA	39,454.10	8,099.58	79.5
CHELTENHAM	NA	NA	14,079.17	3,795.37	73.0
SPRINGFIELD	NA	NA	269,920.19	68,203.21	74.7
UPPER DUBLIN	NA	NA	27,218.89	5,637.29	79.3
WHITEMARSH	NA	NA	2,750.43	673.39	75.5
Total Overland Wasteload Allocations				**86,408.84**	

Table G-40. Sediment load from contributing upstream watersheds (subwatersheds 2 and 3)

Subwatersheds	Annual Average Load (lbs/year)	Sediment Delivery Ratio	Load Delivered from Stream (lbs/year)	LA (avg. annual) (lbs/year)	% Reduction
Subwatersheds 2 and 3	11,540,368.12	0.17	1,961,865.64	1,961,865.64	0.0
Total Load Allocations				**1,961,865.64**	

Subwatershed 5

Table G-41. TMDL for subwatershed 5 (including listed segments 971208-1235-ACE, 971208-1430-ACE, 971209-1200-ACE, 971209-1430-ACE, and 971208-1000-ACE

TMDL (lbs/year)	WLA (lbs/year)	LA (lbs/year)	MOS (lbs/year)
4,776,550.28	3,126,247.90	1,172,647.35	477,655.03

*The WLA includes the collective load from the point sources at the mouth of subwatershed 5 after the sediment delivery ratio of 0.185 was applied to account for transport losses

Table G-42. Wasteload allocations for streambank erosion in Segment 971208-1235-ACE in subwatershed 5

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Philadelphia	802,729.19	179,569.73	77.6
Total Streambank Wasteload Allocations		**179,569.73**	

Table G-43. Wasteload allocations for overland load in Segment 971208-1235-ACE in subwatershed 5

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
PHILADELPHIA	NA	NA	146,430.90	50,615.38	65.4
Total Overland Wasteload Allocations				**50,615.38**	

Table G-44. Wasteload allocations for streambank erosion in Segment 971208-1430-ACE in subwatershed 5

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Philadelphia	1,877,377.99	419,967.62	77.6
Total Streambank Wasteload Allocations		**419,967.62**	

Table G-45. Wasteload allocations for overland load in Segment 971208-1430-ACE in subwatershed 5

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
PHILADELPHIA	NA	NA	301,527.00	99,900.28	66.9
Total Overland Wasteload Allocations				**99,900.28**	

Table G-46. Wasteload allocations for streambank erosion in Segment 971209-1200-ACE in subwatershed 5

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Philadelphia	2,700,153.80	604,021.76	77.6
Stream Bank Erosion Springfield	530,230.12	118,611.96	77.6
Total Streambank Wasteload Allocations		**722,633.72**	

Table G-47. Wasteload allocations for overland load in Segment 971209-1200-ACE in subwatershed 5

NPDES/Township (MS4)	Flow (cfs)	TSS (mg/L)	Annual Average	WLA (avg. annual)	% Reduction

			Load (lbs/year)	(lbs/year)	
PHILADELPHIA	NA	NA	347,579.42	129,852.69	62.6
SPRINGFIELD	NA	NA	94,612.08	32,754.42	65.4
Total Overland Wasteload Allocations				**162,607.11**	

Table G-48. Wasteload allocations for streambank erosion in Segment 971209-1430-ACE in subwatershed 5

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Philadelphia	4,225,045.92	945,138.64	77.6
Stream Bank Erosion Springfield	1,149.57	257.16	77.6
Total Streambank Wasteload Allocations		**945,395.80**	

Table G-49. Wasteload allocations for overland load in Segment 971209-1430-ACE in subwatershed 5

NPDES/Township	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
PHILADELPHIA	NA	NA	396,967.30	188,442.85	52.5
SPRINGFIELD	NA	NA	64.68	64.8	0.0
Total Overland Wasteload Allocations				**188,507.52**	

Table G-50. Wasteload allocations for streambank erosion in Segment 971208-1000-ACE in subwatershed 5

Township (MS4)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
Stream Bank Erosion Philadelphia	1,280,468.89	286,439.64	77.6
Total Streambank Wasteload Allocations		**286,439.64**	

Table G-51. Wasteload allocations for overland load in Segment 971208-1000-ACE in subwatershed 5

NPDES/Township	Flow (cfs)	TSS (mg/L)	Annual Average Load (lbs/year)	WLA (avg. annual) (lbs/year)	% Reduction
PHILADELPHIA	NA	NA	164,786.62	70,611.10	57.1
Total Overland Wasteload Allocations				**70,611.10**	

Table G-52. Sediment load from contributing upstream watersheds (subwatershed 4)

Subwatersheds	Annual Average Load (lbs/year)	Sediment Delivery Ratio	Load Delivered from Stream (lbs/year)	LA (avg. annual) (lbs/year)	% Reduction

Subwatershed 4	6,338,634.32	0.185	1,172,647.35	1,172,647.35	0.0
Total Load Allocations				**1,172,647.35**	

Table G-53. Wasteload allocations for overland loads by landuse for municipalities (MS4s)

Township	Listed Segment	WLAs by Landuse (lbs/yr)								
		Low-Intensity Residential	High-Intensity Residential	Hay/Pasture	Row Crops	Coniferous Forest	Mixed Forest	Deciduous Forest	Transitional	TOTAL
Abington	971215-1133-ACE	69,154.59	11,179.20	4,220.85	7,568.68	49.61	441.86	2,353.58	0.00	94,968.38
	971215-1300-ACE	62.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	62.78
	971215-1130-ACE	7,233.55	605.08	28.38	56.57	1.28	8.56	166.16	0.00	8,099.58
Ambler	971216-1415-ACE	7,477.01	3,247.89	106.00	335.34	0.61	33.11	123.94	0.00	11,323.89
	971222-0930-ACE	3,958.29	3,270.77	0.00	1,207.22	0.00	6.99	107.96	0.00	8,551.23
	971222-1130-ACE	182.98	100.64	0.00	134.14	0.00	0.87	2.04	0.00	420.67
Cheltenham	971211-1300-ACE	1,243.99	14.18	0.00	0.00	19.15	19.27	141.04	0.00	1,437.62
	971215-1130-ACE	2,246.09	241.09	104.07	339.41	103.40	51.38	374.82	335.11	3,795.37
Horsham	971217-1145-ACE	481.82	582.27	53.42	0.00	21.92	36.70	73.33	0.00	1,249.45
	971215-1300-ACE	94.17	31.69	17.09	0.00	0.00	1.26	3.12	0.00	147.34
	971215-1303-ACE	83.90	111.22	0.00	68.19	0.00	0.00	1.56	0.00	264.87
Lansdale	971218-1045-ACE	23,282.24	4,602.05	905.34	4,846.94	3.48	132.18	208.74	0.00	33,980.98
	981015-1100-ACE	76.58	64.82	0.00	618.76	0.00	1.77	0.00	0.00	761.93
Lower Gwynedd	971217-1430-ACE	3,171.43	0.00	57.30	1,134.39	3.48	43.22	88.08	0.00	4,497.91
	971218-1345-ACE	9,017.59	502.33	1,111.62	30,319.18	59.91	372.58	1,800.20	0.00	43,183.42
	971216-1415-ACE	7,910.60	722.55	1,282.57	6,639.72	34.70	317.99	422.62	0.00	17,330.75
	971217-1015-ACE	26,087.76	8,141.95	5,718.67	60,830.57	59.66	597.66	1,561.39	0.00	102,997.66
	971217-1145-ACE	41,908.32	2,285.94	1,474.33	40,509.00	95.57	759.31	2,016.67	0.00	89,049.14
	971222-1130-ACE	7,617.76	337.86	1,185.87	11,334.47	59.05	337.28	969.63	0.00	21,841.92
Montgomery	971217-1430-ACE	114.63	110.55	0.00	309.38	0.00	0.00	1.21	0.00	535.77
	971218-1045-ACE	18,308.22	1,566.31	366.72	7,115.73	17.42	181.85	458.50	0.00	28,014.75
	971218-1345-ACE	0.00	16.20	0.00	0.00	0.00	0.00	0.00	0.00	16.20
	981015-1100-ACE	7,390.21	9,284.95	401.10	18,665.89	7.66	37.26	164.09	0.00	35,951.17
	971217-1145-ACE	4,143.61	4,615.02	224.35	1,944.97	1.22	23.59	85.56	0.00	11,038.32
	971222-1130-ACE	28.89	14.38	0.00	0.00	0.00	0.00	0.00	0.00	43.27
North Wales	971217-1430-ACE	3,744.58	142.13	11.46	0.00	0.00	7.94	19.31	0.00	3,925.42
	971218-1045-ACE	1,664.38	16.15	0.00	0.00	0.00	2.66	13.27	0.00	1,696.46
	971218-1345-ACE	10,836.43	4,747.80	114.60	412.51	2.79	31.94	125.48	0.00	16,271.54
	981015-1100-ACE	4,154.60	453.71	11.46	0.00	0.70	17.74	51.88	0.00	4,690.10
Philadelphia	971208-1000-ACE	29.79	3.73	0.00	113.52	3.69	4.76	392.21	0.00	547.70
	971209-0930-ACE	7,152.92	496.36	444.68	1,131.38	178.71	264.40	1,481.90	0.00	11,150.34
	971211-1300-ACE	2,188.49	113.45	179.76	2,206.19	35.74	39.61	171.95	0.00	4,935.20
	971208-1235-ACE	30,275.59	10,788.20	929.97	6,477.60	53.03	53.66	2,037.32	0.00	50,615.38
	971208-1430-ACE	70,173.41	16,238.04	833.36	4,119.83	155.36	527.30	7,852.97	0.00	99,900.28
	971209-1200-ACE	77,870.43	15,441.03	2,150.19	15,660.04	618.72	1,014.59	17,097.70	0.00	129,852.69
	971209-1430-ACE	73,594.20	15,773.43	8,779.68	36,851.20	945.03	1,843.44	39,152.15	11,503.72	188,442.85
	971208-1000-ACE	30,474.00	9,886.94	930.81	18,985.93	33.47	196.43	10,103.52	0.00	70,611.10
Springfield	971215-1133-ACE	2,396.19	778.65	3,503.13	3,409.31	19.17	104.78	332.89	748.86	11,293.00
	971208-1000-ACE	618.13	37.34	301.91	7,265.14	55.35	95.21	678.82	0.00	9,051.90

Township	Listed Segment	WLAs by Landuse (lbs/yr)								
		Low-Intensity Residential	High-Intensity Residential	Hay/Pasture	Row Crops	Coniferous Forest	Mixed Forest	Deciduous Forest	Transitional	TOTAL
	971209-0930-ACE	9,399.01	1,262.16	2,980.27	14,085.69	57.44	237.64	616.33	0.00	28,638.54
	971211-1300-ACE	41,742.64	1,857.79	2,715.36	7,636.82	343.38	560.91	2,046.07	586.44	57,489.40
	971215-1130-ACE	47,167.80	2,486.51	7,133.73	6,052.89	187.64	523.44	1,551.46	3,099.74	68,203.21
	971209-1200-ACE	21,658.58	4,851.84	1,098.47	3,715.94	90.35	105.82	1,233.42	0.00	32,754.42
	971209-1430-ACE	27.87	36.81	0.00	0.00	0.00	0.00	0.00	0.00	64.68
Upper Dublin	971216-1415-ACE	38,926.70	4,671.52	6,105.47	45,337.89	77.92	853.79	1,713.84	0.00	97,687.14
	971222-0930-ACE	3,361.17	431.31	138.89	2,682.72	38.35	155.53	653.89	0.00	7,461.86
	971215-1133-ACE	30,041.28	3,289.40	13,534.06	4,432.11	82.31	718.34	1,446.68	0.00	53,544.19
	971215-1300-ACE	42,943.02	16,607.23	15,823.92	40,366.27	105.95	1,156.41	2,950.47	0.00	119,953.28
	971215-1303-ACE	22,024.34	13,116.45	3,691.11	36,343.28	190.05	551.69	3,213.22	0.00	79,130.14
	971209-0930-ACE	2,902.63	189.09	0.00	169.71	5.11	40.68	110.13	0.00	3,417.34
	971215-1130-ACE	5,206.31	189.09	85.15	56.57	5.11	13.92	81.15	0.00	5,637.29
Upper Gwynedd	971217-1430-ACE	27,644.97	2,953.25	928.26	57,853.95	38.32	381.90	1,814.68	0.00	91,615.33
	971218-1045-ACE	33,536.38	17,568.54	2,727.48	46,200.66	18.11	257.26	1,242.77	0.00	101,551.19
	971218-1345-ACE	19,088.20	13,741.07	928.26	43,622.50	13.24	85.16	966.46	0.00	78,444.89
	981015-1100-ACE	13,708.27	5,055.68	584.46	15,262.72	6.27	125.08	644.31	0.00	35,386.79
	971217-1145-ACE	424.00	7.19	0.00	134.14	0.00	0.00	1.02	0.00	566.34
	971222-1130-ACE	9.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.63
Upper Moreland	971215-1133-ACE	136.03	0.00	0.00	0.00	6.77	10.10	56.00	0.00	208.89
	971215-1300-ACE	115.10	7.92	153.80	68.19	0.00	12.62	0.00	0.00	357.63
	971209-0930-ACE	0.00	0.00	0.00	0.00	0.00	0.00	1.93	0.00	1.93
Whitemarsh	971222-0930-ACE	3,139.66	93.45	3,055.49	11,602.74	49.31	326.79	774.07	0.00	19,041.52
	971215-1133-ACE	3,923.89	2,757.06	1,982.26	6,477.70	63.14	119.93	1,039.12	13,011.51	29,374.62
	971215-1303-ACE	52.44	0.00	0.00	818.24	1.09	2.52	60.77	0.00	935.07
	971208-1000-ACE	491.52	235.25	123.51	6,357.00	9.84	73.31	588.31	0.00	7,878.74
	971209-0930-ACE	36,259.89	2,458.14	14,030.94	73,256.89	524.64	1,763.01	8,427.72	39,177.21	175,898.44
	971215-1000-ACE	6,358.15	1,711.25	7,398.65	20,308.28	109.78	597.30	4,430.25	0.00	40,913.66
	971215-1130-ACE	391.63	127.63	0.00	113.14	0.00	4.28	36.71	0.00	673.39
Whitpain	971218-1345-ACE	1,206.17	11,488.70	550.08	23,512.84	0.00	3.55	13.27	0.00	36,774.61
	971216-1415-ACE	144.53	214.62	0.00	1,676.70	0.00	5.23	11.18	0.00	2,052.25
	971217-1015-ACE	231.12	35.84	478.33	268.27	0.00	12.23	64.17	0.00	1,089.96
	971222-0930-ACE	31,252.18	1,229.23	5,534.07	69,079.92	66.35	470.09	1,563.42	0.00	109,195.27
	971222-1130-ACE	11,585.55	287.54	10,053.20	21,729.99	130.27	1,065.13	2,011.57	0.00	46,863.25
	971209-0930-ACE	172.78	0.00	28.38	0.00	1.28	7.49	3.86	0.00	213.79
	971215-1000-ACE	2,626.19	0.00	766.36	0.00	22.98	132.73	326.52	0.00	3,874.78
Worcester	971217-1430-ACE	706.89	0.00	11.46	1,134.39	2.09	9.70	27.75	0.00	1,892.28
	971218-1345-ACE	1,493.36	0.00	22.92	5,156.32	0.70	7.98	65.15	0.00	6,746.44

Table G-54. Wasteload allocations for streambank erosion for municipalities (MS4s)

Municipality	Watershed	WLA (lbs/year)
ABINGTON	971215-1130-ACE	65,898.67
ABINGTON	971215-1133-ACE	900,146.90
ABINGTON	971215-1300-ACE	525.69
AMBLER	971216-1415-ACE	161,399.48
AMBLER	971222-0930-ACE	114,541.14
AMBLER	971222-1130-ACE	4,385.74
CHELTENHAM	971211-1300-ACE	16,726.73
CHELTENHAM	971215-1130-ACE	45,473.94
HORSHAM	971215-1300-ACE	1,489.44
HORSHAM	971215-1303-ACE	2,098.87
HORSHAM	971217-1145-ACE	33,284.02
LANSDALE	971218-1045-ACE	84,525.00
LANSDALE	981015-1100-ACE	720.50
LOWER GWYNEDD	971216-1415-ACE	227,635.26
LOWER GWYNEDD	971217-1015-ACE	877,176.02
LOWER GWYNEDD	971217-1145-ACE	970,073.78
LOWER GWYNEDD	971217-1430-ACE	13,318.26
LOWER GWYNEDD	971218-1345-ACE	125,085.13
LOWER GWYNEDD	971222-1130-ACE	294,998.55
MONTGOMERY	971217-1145-ACE	143,731.70
MONTGOMERY	971217-1430-ACE	732.72
MONTGOMERY	971218-1045-ACE	76,232.30
MONTGOMERY	971218-1345-ACE	43.22
MONTGOMERY	971222-1130-ACE	577.07
MONTGOMERY	981015-1100-ACE	60,564.68
NORTH WALES	971217-1430-ACE	9,956.37
NORTH WALES	971218-1045-ACE	4,405.49
NORTH WALES	971218-1345-ACE	44,000.23
NORTH WALES	981015-1100-ACE	13,138.59
PHILADELPHIA	971208-1000-ACE	81,669.64
PHILADELPHIA	971208-1000-ACE	286,439.64
PHILADELPHIA	971208-1235-ACE	179,569.73
PHILADELPHIA	971208-1430-ACE	419,967.62
PHILADELPHIA	971209-0930-ACE	149,321.93
PHILADELPHIA	971209-1200-ACE	604,021.76
PHILADELPHIA	971209-1430-ACE	945,138.64
PHILADELPHIA	971211-1300-ACE	32,836.81
SPRINGFIELD	971208-1000-ACE	19,526.06
SPRINGFIELD	971209-0930-ACE	171,256.23
SPRINGFIELD	971209-1200-ACE	118,611.96
SPRINGFIELD	971209-1430-ACE	257.16
SPRINGFIELD	971211-1300-ACE	485,614.87
SPRINGFIELD	971215-1130-ACE	536,592.47
SPRINGFIELD	971215-1133-ACE	80,979.95
UPPER DUBLIN	971209-0930-ACE	30,217.18
UPPER DUBLIN	971215-1130-ACE	43,238.78
UPPER DUBLIN	971215-1133-ACE	500,324.80
UPPER DUBLIN	971215-1300-ACE	930,988.21
UPPER DUBLIN	971215-1303-ACE	629,311.47
UPPER DUBLIN	971216-1415-ACE	1,008,344.99
UPPER DUBLIN	971222-0930-ACE	159,301.71
UPPER GWYNEDD	971217-1145-ACE	5,528.14
UPPER GWYNEDD	971217-1430-ACE	184,214.41
UPPER GWYNEDD	971218-1045-ACE	210,599.84
UPPER GWYNEDD	971218-1345-ACE	141,207.02
UPPER GWYNEDD	971222-1130-ACE	115.41
UPPER GWYNEDD	981015-1100-ACE	81,332.14
UPPER MORELAND	971209-0930-ACE	76.69
UPPER MORELAND	971215-1133-ACE	5,515.39
UPPER MORELAND	971215-1300-ACE	2,803.65

Municipality	Watershed	WLA (lbs/year)
WHITEMARSH	971208-1000-ACE	15,960.64
WHITEMARSH	971209-0930-ACE	1,029,914.85
WHITEMARSH	971215-1000-ACE	388,503.79
WHITEMARSH	971215-1130-ACE	6,628.40
WHITEMARSH	971215-1133-ACE	165,987.02
WHITEMARSH	971215-1303-ACE	5,159.72
WHITEMARSH	971222-0930-ACE	231,033.38
WHITPAIN	971209-0930-ACE	2,147.41
WHITPAIN	971215-1000-ACE	44,156.25
WHITPAIN	971216-1415-ACE	10,101.82
WHITPAIN	971217-1015-ACE	17,838.14
WHITPAIN	971218-1345-ACE	45,945.23
WHITPAIN	971222-0930-ACE	822,791.03
WHITPAIN	971222-1130-ACE	682,790.07
WORCESTER	971217-1430-ACE	3,706.70
WORCESTER	971218-1345-ACE	8,385.11

Appendix H

EXECUTIVE SUMMARY
COMPREHENSIVE STORMWATER MANAGEMENT POLICY
DOCUMENT NUMBER: 392-0300-002

At the 15 water forums held throughout the Commonwealth in 2001, stormwater management was a consistent issue identified by the forum participants. In addition, stormwater management is a priority issue identified in the Environmental Futures Planning process throughout the 34 watershed planning areas within the Commonwealth. Stormwater runoff has also been identified as one of the top three causes of water quality impairment in the Department's Clean Water Act Section 303(d) listing process. Finally, DEP must implement the federal Clean Water Act Phase II NPDES stormwater permit program by December 2002.

In response to the forums, the Environmental Futures Planning process, stream impairment listings and federal program requirements, on October 27, 2001, the Department published a proposed comprehensive stormwater management policy to more fully integrate post construction stormwater planning requirements, emphasizing the use of ground water infiltration and volume and rate control best management practices (BMPs), into the existing and proposed NPDES permitting programs and the Stormwater Management Act ("Act 167") Planning Program. Specifically, the Department proposed the following:

- The consistent application of existing legal requirements to protect water quality in all stormwater programs, including the protection and maintenance of existing uses and the physical, chemical and biological characteristics of surface waters.

- The integration of the municipally implemented Act 167 stormwater management programs into the NPDES permitting process for urbanized areas requiring Municipal Separate Storm Sewer System (MS4) NPDES Permits for Stormwater Discharges.

- The integration of consistent post construction stormwater management planning processes emphasizing, and sometimes requiring, water quality and quantity infiltration and volume and rate control BMPs into the permit process for NPDES Stormwater Discharges Associated with Construction Activity.

- The use of a Chapter 91 Water Quality Management Part II Permit to ensure the maintenance and operation of the post construction stormwater BMPs after the earth disturbance activities are completed.

More than 600 comments were received from 234 individuals and organizations during the public comment period on the draft policy. Comments ranged from strong support to strong opposition. The major comments focused on the following areas:

Use of existing authority: Many commentators support the use of exiting authority. Others object to portions of the policy asserting that the Department should instead undertake a formal rulemaking subject to public review and comment, as well as review and approval by the Environmental Quality Board and the Independent Regulatory Review Commission.

Use of the Part II WQM permit for post construction stormwater: While many commentators generally support this approach, there are numerous requests for more clarification on the administration of this proposed permit requirement. Others question the legal authority for the permit. A few commentators suggest the existing NPDES permit process should be used because it is already in place and also provides federal EPA oversight.

Best Management Practice Manual: Many commentators suggest that the Department develop a technical manual accompanied by training to ensure consistent program administration and implementation.

Consistency with the Department's Antidegradation Policy: Many commentators suggest that the use of current regulations prohibiting degradation of existing uses of waterways needs to be emphasized and clarified.

Funding and Staffing: Some commentators question the absence of an analysis relative to the costs of implementing the suggested BMPs. Many commentators express concerns relative to costs and staffing within the Department and County Conservation Districts to support the implementation of the policy. Commentators also request clarification regarding various funding resources such as PennVEST and Act 167 to support the policy.

Science, Foundation, and Technical Feasibility for the Policy: Many commentators raise concerns that the objectives stated in the policy relative to infiltration BMPs, and groundwater recharge were not fully developed, practical or in some cases feasible. Some commentators question the Department's scientific foundation for the development of the policy while many other commentators clearly believe that streams have been severely impacted by poor or inadequate stormwater management practices and support the proposed policy.

Compensation (mitigation) for stormwater impacts: Several commentators question the proposed compensation option for sites in EV wetlands where infiltration cannot be achieved. Some express concerns that compensation provides a way out for persons affected by the policy and may be abused. Others are concerned about the lack of guidance in determining how someone compensates for potential impacts.

Expand the Policy: Many commentators suggest that the requirement to infiltrate stormwater should be expanded to all waterways regardless of their designated or existing use. Many are concerned that waters other than special protection receive no or limited protection under the proposed policy.

SUMMARY OF RELATED ACTIONS

Since announcement of the Proposed Comprehensive Stormwater Management Policy in October 2001, the Department has proposed, revised or otherwise finalized the following related documents:

- Renewal of NPDES Stormwater Construction General Permit (5 acres or greater)
- Proposed NPDES Stormwater Construction General Permit (1-5 acres)
- Proposed MS4 General Permit

- Renewal of NPDES Industrial General Permit
- Revised Act 167 Model Ordinance
- EPA has approved funding to support the development of a Post Construction Stormwater Technical BMP Manual

SUMMARY OF THE FINAL POLICY

The final policy sets forth the Department's general framework for implementing its stormwater management programs, using existing legal authority. In particular, the policy promotes and integrates the following into the Department's existing stormwater management programs:

- A clarification of the application of existing antidegradation provisions in 25 Pa. Code Section 93.4a to the BMP-based stormwater programs to protect and maintain existing uses and maintain water quality necessary to support those uses in all streams and to protect and maintain water quality in special protection streams.

- A uniform approach to post construction stormwater management that emphasizes ground water recharge through infiltration, water quality treatment and discharge volume and rate control with a goal of replicating infiltration and runoff characteristics of the site prior to development.

- The proposed Part II Water Quality Management permit is not included in the final policy. Instead, post construction stormwater management planning has been integrated into the NPDES stormwater permitting programs.

- The promotion of a comprehensive watershed approach to stormwater management through the Act 167 stormwater management planning program.

- The final policy clarifies that existing Department policies and programs related to flood protection and combined sewer overflows are not affected by this policy.

Fundamentally, the policy emphasizes the reduction of stormwater runoff generated by development and other activities by encouraging the minimization of impervious cover, use of low impact development designs, and the use of innovative stormwater BMPs that provide infiltration, water quality treatment, and otherwise more effectively manage the volume and rate of stormwater discharges. These stormwater BMPs and planning practices will be advanced through increased emphasis on the Department's Act 167 stormwater management planning program and implementation of the new (Phase II) and existing (Phase I) NPDES Stormwater Discharge Associated with Construction Activity Permit programs, and the new NPDES MS4 permits.

Administratively the Department is advancing a consistent approach to stormwater management in all NPDES stormwater permits and in the Act 167 stormwater planning processes. Department-approved Act 167 stormwater management plans and NPDES permits required under the federal Clean Water Act will include the same planning objectives to protect and maintain existing uses and maintain the level of water quality necessary to protect those uses in all streams, and to protect and maintain water quality in special protection streams. For instance, municipalities who follow the recommended stormwater planning protocol in the MS4 General Permit described in this policy can satisfy those planning objectives in both the applicable NPDES permits and the Act 167 stormwater planning requirements. In addition, persons implementing post construction stormwater plans under Act 167 that emphasize infiltration, water quality treatment and other volume and rate controls can also satisfy the post construction stormwater management planning requirements of the NPDES Stormwater Discharge Associated with Construction Activity Permit and the MS4 Permit.

The terms stormwater and stormwater management as utilized throughout the policy refer to increased volumes and rates of runoff resulting from construction and land development activities. Stormwater management as recommended in this policy is not intended to address over bank flooding resulting from major storm events. Stream and river flooding from major storm events is addressed through the Department's Flood Protection and Stream Improvement Programs.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMPREHENSIVE
STORMWATER MANAGEMENT
POLICY

Document ID # 392-0300-002

September 28, 2002

DOCUMENT NUMBER: 392-0300-002

TITLE: Comprehensive Stormwater Management Policy

EFFECTIVE DATE: September 28, 2002

AUTHORITY:

Pennsylvania Clean Streams Law (35 P.S. §§ 691.1-691.1001); Pennsylvania Stormwater Management Act (32 P.S. §§ 680.1-680.17); Federal Clean Water Act (33 U.S.C.A § 1342), 40 CFR Part 122 and 25 Pa Code Chapters 92, 93, 96, 102, 105, and 111.

POLICY:

The Department will ensure activities and plans approved under its authority will employ stormwater management plans utilizing best management practices to protect and maintain ground water resources, preserve ground water supplies, maintain stream base flows, and protect, preserve, and maintain the physical stability, and environmental integrity of waters of the Commonwealth.

PURPOSE:

Clean, reliable ground water and surface water resources are critical for sustaining the environmental health of our natural resources, protecting the public's health and safety, and maintaining the economic vitality of the Commonwealth. The purpose of this policy is to ensure effective stormwater management to minimize the adverse impacts of stormwater on ground water and surface water resources to support and sustain the social, economic and environmental quality of the Commonwealth, and to integrate federal Clean Water Act Stormwater Management requirements.

APPLICABILITY:

This policy applies to all Department programs implementing stormwater management.

DISCLAIMER:

The policies and procedures outlined in this guidance document are intended to supplement existing requirements. Nothing in the policies or procedures shall affect regulatory requirements. The policies and procedures herein are not adjudications or regulations. There is no intent on the part of DEP to give the rules in these policies that weight or deference. This document establishes the framework within which DEP will exercise its administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.

PAGE LENGTH: 8 pages

LOCATION: Volume 15, Tab 21

COMPREHENSIVE STORMWATER MANAGEMENT POLICY

This policy document describes the Department's update of its stormwater management programs, using existing authority, to improve water quality, sustain water quantity including ground water recharge and stream base flow, and to implement federal stormwater management obligations.

This policy provides a framework for the integration of all Department stormwater management programs and promotes a comprehensive watershed approach to stormwater management in the Commonwealth. This policy identifies and integrates existing legal requirements and post construction stormwater management planning goals, objectives, and recommended procedures into the various Department stormwater management programs.

Unmanaged or poorly managed stormwater can result in stream bank scour, stream destabilization, sedimentation, loss of groundwater recharge, loss of base flow, localized flooding, habitat modification and water quality and quantity impairment. Conversely, properly managed stormwater through properly constructed and maintained best management practices (BMPs) can remove pollutants, facilitate ground water recharge through retention and infiltration, provide base flow for surface waters, and maintain the stability and the environmental integrity of waterways and wetlands. To provide long-term protection and sustainability of ground and surface water resources, stormwater should be managed at the source or origin as an environmental resource to be protected rather than as a waste to be quickly discharged and moved downstream.

Fundamentally, the goals of the policy are to improve and sustain ground and surface water quality and quantity through the use of planning practices and BMPs that minimize the generation of stormwater runoff, provide ground water recharge and minimize the adverse effects of stormwater discharges on ground and surface water resources. This policy also supports the fulfillment of the state's obligation under 25 Pa. Code Section 93.4a to protect and maintain existing uses and the level of water quality necessary to protect those uses in all surface waters and to protect and maintain water quality in "special protection" waters. Special protection waters are Pennsylvania's highest quality surface waters and include Exceptional Value (EV) and High Quality (HQ) waters.

RECOMMENDED POST CONSTRUCTION STORMWATER MANAGEMENT PROCESS TO MEET REGULATORY STANDARDS

Procedurally, post construction stormwater management plans required under the NPDES Stormwater Discharges Associated with Construction Activities permit program and the NPDES Municipal Separate Storm Sewer System (MS4) permit program, as well as stormwater management plans developed under the Act 167 program, must demonstrate compliance with the antidegradation requirements at 25 Pa. Code Section 93.4a to protect and maintain existing uses and the level of water quality necessary to protect those uses in all surface waters and protect and maintain water quality in special protection waters.

This policy recommends that in order to meet the regulatory requirements of 25 Pa. Code Section 93.4a, persons involved in the development of post construction stormwater management plans should prepare a comparative pre and post construction stormwater management analysis.

In watersheds other than special protection, based upon the comparative stormwater management analysis, planners and applicants should evaluate and utilize infiltration BMPs to manage the net change in stormwater generated or otherwise replicate to the maximum extent possible preconstruction stormwater infiltration and runoff conditions so that post construction stormwater discharges do not degrade the physical, chemical or biological characteristics of the receiving waters. Additionally, water quality treatment BMPs must be employed where necessary to ensure protection of existing uses and the level of water quality necessary to protect those existing uses. Finally, the volume and rate of stormwater discharges must be managed to prevent the physical degradation of receiving waters, such as scour and streambank destabilization.

In special protection watersheds, based upon the comparative stormwater management analysis, planners and applicants can ensure that existing water quality will be protected and maintained by demonstrating that post construction infiltration equals or exceeds preconstruction infiltration and that any post construction discharge will not degrade the physical, chemical or biological characteristics of the special protection surface water. In these special protection watersheds, infiltration BMPs should be used to the maximum extent possible. To the extent that planners and applicants cannot totally infiltrate stormwater to pre construction volumes due to site conditions or limitations, off-site compensation projects in the same watershed and preferably upstream of the project site should be evaluated and employed to protect and maintain water quality. Additionally, water quality treatment BMPs must be employed where necessary to ensure the protection and maintenance of water quality. Finally, the volume and rate of stormwater discharges must be managed to prevent the physical degradation of receiving waters, such as scour and streambank destabilization.

Overall, the implementation of these stormwater management approaches will meet the requirements of 25 Pa. Code Section 93.4a by reducing pollutant loads to streams, recharging aquifers, protecting stream base flows, preventing stream bank erosion and streambed scour, and protecting the environmental integrity of receiving waters.

INTEGRATION OF POST CONSTRUCTION STORMWATER MANAGEMENT PLANNING INTO EXISTING STORMWATER PROGRAMS

NPDES Stormwater Discharge Associated with Construction Activity Permit Program

Pennsylvania regulates stormwater impacts occurring during construction under the Erosion and Sediment Pollution Control Program. All earth disturbances of 5000 square feet or greater require the development and implementation of an erosion and sediment control plan under 25 Pa. Code Chapter 102. Erosion and sediment control BMPs are used to minimize the potential for accelerated erosion and sediment pollution from these activities. The Department has developed a manual, "Erosion and Sediment Pollution Control Program Manual," that identifies BMPs, provides recommended site design standards and specifications as well as their applicability to various situations. For High Quality (HQ) and Exceptional Value (EV) watersheds, there are more protective BMP requirements contained in Chapter 102. Beyond these planning and implementation requirements persons conducting earth disturbance activities are required to secure the appropriate NPDES permit as follows:

Phase I Earth Disturbances 5 Acres or Greater

EPA regulations implementing the Clean Water Act require NPDES permits for construction activities of five (5) acres or greater (Phase I). Using its existing authority pursuant to the Department's regulations found in 25 Pa. Code Chapters 92, 93, 96 and 102, Pennsylvania began to implement the Phase I Stormwater NPDES program in 1992. Under the Department's regulations, any earth disturbance 5 acres or greater (including earth disturbances of less than 5 acres that occur as a part of a larger common plan of development or sale consisting of 5 acres or more) requires a permit prior to the commencement of the earth disturbance. An individual NPDES permit is required for projects located in HQ and EV watersheds and in most circumstances a general permit is available for use in all other watersheds. The Department has delegated the primary functions and responsibilities of the program to County Conservation Districts under the authority contained in the Conservation District Law.

Phase II Earth Disturbance between 1 and 5 acres

In 1999, EPA promulgated Phase II stormwater regulations establishing NPDES permit requirements for construction activities with between 1 and 5 acres of earth (including earth disturbances less than 1 acre that occur as part of a larger common plan of development or sale between 1 and 5 acres), with a point source discharge. Pennsylvania is required to implement the Phase II requirements by December 8, 2002.

An NPDES Phase II permit is not required for earth disturbance activities of between 1 and 5 acres unless there is point source discharge of stormwater to surface waters of the Commonwealth. For activities that do not have a point source discharge, the erosion and sediment pollution control plan requirements in Chapter 102 described above will be used as the substantive environmental control requirements for those projects. Earth disturbance activities of between 1 and 5 acres (small construction sites) that include a point source discharge and which are located in HQ and EV watersheds require an individual NPDES permit. In most circumstances a general permit is available for use in all other watersheds.

Integration of Post Construction Stormwater Management Plans into NPDES Stormwater Discharge Associated with Construction Activity Permits

Since 1990, the Federal NPDES regulations have required the identification of post construction stormwater management BMPs in the permit application or Notice of Intent for General Permit users. To further advance effective stormwater management and to support the regulatory requirements found at 25 Pa. Code Section 93.4a, the Department has amended the permit application and Notice of Intent for General Permits to require the identification of post construction stormwater management BMPs within a site specific post construction stormwater management plan. Post Construction Stormwater Management Plans should be developed in accordance with the process described above and supported by references listed in Appendix A of this policy.

NPDES Municipal Separate Storm Sewer System (MS4) Discharge Permit Program

The federal Phase II stormwater regulations also established NPDES permit requirements for MS4 discharges from Municipal Separate Storm Sewer Systems (MS4s). Pennsylvania is required to implement these MS4 requirements by December 2002. Based on 1990 census data there are approximately 700 municipalities and other facilities within the Commonwealth that must meet the Phase II permit requirements.

In general terms, the MS4 permit requirements are to develop, implement and enforce a BMP based stormwater program with these six elements:

1. implement a public education program;
2. include public involvement in decision making;
3. eliminate or treat discharges not composed entirely of stormwater;
4. require erosion and sediment controls for construction activities;
5. require BMPs to manage post-construction stormwater for new development and redevelopment; and
6. require pollution prevention/good housekeeping for municipal operations.

EPA's Phase II regulations allow existing state and local regulatory programs to be used to meet the MS4 requirements. The Department will use a general permit to cover the required program elements in watersheds other than special protection. Pennsylvania will use the Stormwater Management Act ("Act 167") Program as a centerpiece of the MS4 program for Pennsylvania. In general, municipalities that have developed and are implementing an Act 167 Plan developed on a watershed basis that includes the water quality protective measures, including an MS4 module, will be able to meet the EPA MS4 NPDES requirements through the Act 167 process.

Municipalities that are required to obtain an MS4 permit but which have discharges to watersheds without an approved Act 167 Plan that meets the water quality requirements of 25 Pa. Code Section 93.4a, will be encouraged to work with their county to develop a stormwater plan that meets the requirements of Act 167 and the Phase II MS4 permit. Financial assistance for that effort is authorized under Act 167, and a special MS4 module is available for this purpose. Municipalities that do not want to participate in the Act 167 process will be required to develop a separate municipal plan to meet the MS4 requirements, without the use of state cost-sharing funding under Act 167.

Integration of Post Construction Stormwater Management Plans into Act 167 Stormwater Management Plans and MS4 permits

Under the Stormwater Management Act (Act 167), counties are required to develop a watershed based stormwater management plan that is implemented by affected municipalities through municipal ordinances. Both the statute and implementation guidelines require these plans to include provisions to protect water quality, existing uses and the level of water quality necessary to protect those existing uses in all surface waters and to protect and maintain water quality in special protection waters. Funding has generally been available from the Department to cover

75% of the cost to develop the plan. Act 167 also authorizes funding to support municipal implementation of ordinances adopted under the Act 167 plan.

This program has evolved since it began in 1979. Watershed based stormwater management plans developed under Act 167 approved by the Department will include water quality and quantity protection requirements to be implemented by municipalities at the local level as discussed above. Where Act 167 plans implement these water quality and quantity requirements, individuals and the Department may rely on those Act 167 plans and implementing municipal ordinances to meet the relevant MS4 NPDES permitting requirements for municipalities under the Clean Water Act Phase II stormwater program.

The Department will encourage the use of Act 167 plans to facilitate implementation of the new MS4 NPDES permit program, described above, by including an "MS4 module" in the planning process. In this way, municipalities required to meet the MS4 requirement will be able to do so using the watershed plans, cost-share funds and municipal ordinances available under Act 167.

NPDES Industrial Stormwater Permit Program

The existing Phase I of the federal NPDES stormwater permitting regulations for industrial facilities includes eleven (11) categories of industrial activity that are required to be permitted, including the construction activities discussed previously in this policy (5 acres or more).

A permit exception is incorporated in the Phase II program. This exception is referred to as the "no exposure certification" exception. The exception allows all but 1 (construction) of the 11 industrial activities to bypass the permitting process and requirements if their industrial activities and materials are not "exposed to stormwater." A similar exception, under Phase I, only applied to one industrial activity, commonly referred to as "light industry." "Light industry" operators were not required to submit any information supporting their claim for the exception.

The Phase II program covers the same industrial categories but expands the "no exposure" permit exception. The exception previously enjoyed by "light industry" activities is now available for all categories (except for construction activity) listed under the definition of "industrial activity." The new rule allows for a simple and cost-effective way to comply with permitting provisions when industrial activities and materials are completely sheltered from stormwater. Under the EPA rule, operators now have the option of either applying for a permit, or submitting a "no exposure certification" form, conditioned on the discharge not contributing "to the violation of, or interfering with the attainment or maintenance of, water quality standards, including designated uses."

The Department will implement the no exposure certification by amending its existing stormwater discharge general permit for industrial activities. The next permit revision will provide all permittees with an option to either submit the Notice of Intent for coverage under the statewide general permit, or to submit a "no exposure certification" statement. The certifications must be made on a facility wide basis and are required every five years.

Flood Protection and Combined Sewer Overflow Programs

While stormwater management is related to flood protection this policy is not intended to address major flood events on streams and rivers or modify existing flood protection programs and policies of the Department. Additionally, this policy is not intended to modify or otherwise affect existing policies and programs of the Department related to combined sewer overflows.

TECHNICAL SUPPORT AND GUIDANCE

There are numerous sources of technical support and guidance available in print and electronically which provide an array of development planning options and post construction stormwater BMPs that can be used to meet the objectives of this policy and underlying legal requirements. A list of recently developed manuals and reference materials is included in Appendix A of this policy. The Department is in the process of developing a Pennsylvania specific post construction stormwater BMP manual that is expected to be available in 2004.

Appendix A

Stormwater Management BMP Manuals

Delaware Conservation Design For Stormwater Management Guidance Manual (1997)
Address: DNREC
Division of Soil and Water Conservation
Sediment and Stormwater Program
89 Kings Highway
Dover, DE 19901
Website: http://www.dnrec.state.de.us/dnrec2000/Divisions/Soil/Stormwater/Apps/DesignManualRequest.htm
Cost: $25

2000 Maryland Stormwater Design Manual (10/2000)
Address: Maryland Department of the Environment
Water Management Administration
Nonpoint Source Program
2500 Broening Highway
Baltimore, MD 21224
(410) 631-3543 or 1-800-633-6101
Website: http://www.mde.state.md.us/environment/wma/stormwatermanual/Manual_CD/Introduction.pdf
http://www.mde.state.md.us/environment/wma/stormwatermanual/publist2.htm
Cost: October 2000 edition, web download – free
April 2000 edition, printed version - $25

Revised Manual for New Jersey: Best Management Practices for Control of Nonpoint Source Pollution from Stormwater (5/2000, 5th draft)
Address: NJDEP
Division of Watershed Management
Sandra A. Blick
PO Box 418
Trenton, NJ 08625-0418
H2Oshed@dep.state.nj.us
Website: http://www.state.nj.us/dep/watershedmgt/bmpmanual.htm
Cost: web download - free

New York State Stormwater Management Design Manual (10/2001)
Address: New York State
Department of Environmental Conservation
625 Broadway
Albany, NY 12233
Webpage: http://www.dec.state.ny.us/website/dow/swmanual/swmanual.html
Cost: web download - free

Pennsylvania Handbook of Best Management Practices for Developing Areas (1997)

Address: PACD
225 Pine St.
Harrisburg, PA 17101
(717) 236-1006
(717) 236-6410 - fax

Website: http://www.pacd.org/products/bmp/bmp_handbook.htm
http://www.pacd.org/products/bmp/bmp_orderform.htm

Cost: web download – free (limited browser version)
printed version - $20-30

Center for Watershed Protection

Address: 8391 Main Street
Ellicott City, MD 21043-4605
(410) 461-8323
(410) 461-8324 - fax

Website: http://www.cwp.org/

Pennsylvania Department of Environmental Protection

Address: Division of Waterways, Wetlands and Erosion Control
P. O. Box 8775
Harrisburg, PA 17105-8775
(717) 787-6827
(717) 787-5986 – fax

Website: http://www.dep.state.pa.us/dep/deputate/watermgt/wc/subjects/stormwatermanagement.htm
http://www.dep.state.pa.us/dep/deputate/watermgt/wc/subjects/WWEC/StrmH2O_Home.htm

Address: Southeast Regional Office
Lee Park, Suite 6010
555 North Lane
Conshohocken, PA 19428
(610) 832-6130
(610) 832-6133 – fax

Website: http://www.dep.state.pa.us/dep/deputate/fieldops/se/water/PCSWM.htm

Appendix I

Stormwater Runoff Water Quality Science/Engineering Newsletter
Devoted to Urban/Rural Stormwater Runoff
Water Quality Management Issues

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Volume 5 Number 5
December 2, 2002

Editor: Anne Jones-Lee, PhD
Contributor to this Issue:
G. Fred Lee, PhD, PE, DEE

* * * * *

This issue of the Newsletter is primarily devoted to a presentation of a recent US EPA headquarters memorandum, "Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs." This memo establishes the Bush Administration US EPA policy for including NPDES permitted urban and highway stormwater runoff in TMDLs. There are still some important unresolved issues concerning how the US EPA approach will be implemented with respect to the BMP ratcheting down process to ultimately achieve water quality standards (see NLs 1-2, 1-5). As discussed in previous Newsletters (see NLs 1-2, 1-3, 1-5, and 2-2) all NPDES permitted discharges must not cause or contribute to violations of water quality standards. In the past and under this recently announced policy for incorporating NPDES permitted urban and highway stormwater runoff in TMDLs, this requirement still stands. However, the timetable for controlling violations of water quality standards caused by urban stormwater runoff still has not been established. This situation is not surprising since, as discussed in previous Newsletters (see NL 3-3), compliance with water quality standards associated with urban stormwater runoff from developed areas will cost the public served by the storm sewer system from $5 to $10 per person per day. Previous issues of this Newsletter that discuss these issues are available from www.gfredlee.com.

The Water Environment Federation (WEF) has recently held a three day conference in Phoenix, AZ devoted to WEF 2002 TMDL Science and Policy. The proceedings from this conference will be of interest to all of those interested in TMDL issues. About 100 papers were presented on various TMDL science/policy issues. There were over 450 attendees including US EPA HQ and Regional senior staff in the TMDL program and other programs. Based on the discussions, major changes are likely in the national TMDL program in the next year. There were sessions of about six papers each on each of the major TMDL topics including water quality monitoring, water quality modeling, uncertainty in modeling of water quality, reasonable assurance, water quality standards, relationship between water quality standards and beneficial uses, nutrients and N and P water quality standards, urban stormwater quality standards/variances, clean sediment management issues, narrative standard implementation in TMDLs, biological impact and assessment issues, stakeholder involvement, BMP effectiveness, revised use attainability analysis, NPS load allocation issues, pollutant trading, pathogens, human vs animal fecal coliform source tracing, etc. There were several papers presented at this conference devoted to how states are addressing the regulation of urban stormwater runoff causing violations of water quality standards.

According to the WEF website, www.wef.org, papers are now available for purchase and download from the 2002 National TMDL Science and Policy Conference. The WEF has established a link from its website to view abstracts for individual papers.

US EPA Washington DC

November 22, 2002

MEMORANDUM

SUBJECT: Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs

FROM: Robert H. Wayland, III, Director /S/

Office of Wetlands, Oceans and Watersheds

James A. Hanlon, Director /S/

Office of Wastewater Management

TO: Water Division Directors

Regions 1 - 10

This memorandum clarifies existing EPA regulatory requirements for, and provides guidance on, establishing wasteload allocations (WLAs) for storm water discharges in total maximum daily loads (TMDLs) approved or established by EPA. It also addresses the establishment of water quality-based effluent limits (WQBELs) and conditions in National Pollutant Discharge Elimination System (NPDES) permits based on the WLAs for storm water discharges in TMDLs. The key points presented in this memorandum are as follows:

- NPDES-regulated storm water discharges must be addressed by the wasteload allocation component of a TMDL. See 40 C.F.R. § 130.2(h).
- NPDES-regulated storm water discharges may not be addressed by the load allocation (LA) component of a TMDL. See 40 C.F.R. § 130.2 (g) & (h).
- Storm water discharges from sources that are not currently subject to NPDES regulation may be addressed by the load allocation component of a TMDL. See 40 C.F.R. § 130.2(g).
- It may be reasonable to express allocations for NPDES-regulated storm water discharges from multiple point sources as a single categorical wasteload allocation when data and information are insufficient to assign each source or outfall individual WLAs. See 40 C.F.R. § 130.2(i). In cases where wasteload allocations are developed for categories of discharges, these categories should be defined as narrowly as available information allows.
- The WLAs and LAs are to be expressed in numeric form in the TMDL. See 40 C.F.R. § 130.2(h) & (i). EPA expects TMDL authorities to make separate allocations to NPDES- regulated storm water discharges (in the form of WLAs) and unregulated storm water (in the form of LAs). EPA recognizes that these allocations might be fairly rudimentary because of data limitations and variability in the system.

- NPDES permit conditions must be consistent with the assumptions and requirements of available WLAs. See 40 C.F.R. § 122.44(d)(1)(vii)(B).
- WQBELs for NPDES-regulated storm water discharges that implement WLAs in TMDLs may be expressed in the form of best management practices (BMPs) under specified circumstances. See 33 U.S.C. §1342(p)(3)(B)(iii); 40 C.F.R. §122.44(k)(2)&(3). If BMPs alone adequately implement the WLAs, then additional controls are not necessary.
- EPA expects that most WQBELs for NPDES-regulated municipal and small construction storm water discharges will be in the form of BMPs, and that numeric limits will be used only in rare instances.
- When a non-numeric water quality-based effluent limit is imposed, the permit's administrative record, including the fact sheet when one is required, needs to support that the BMPs are expected to be sufficient to implement the WLA in the TMDL. See 40 C.F.R. §§ 124.8, 124.9 & 124.18.
- The NPDES permit must also specify the monitoring necessary to determine compliance with effluent limitations. See 40 C.F.R. § 122.44(i). Where effluent limits are specified as BMPs, the permit should also specify the monitoring necessary to assess if the expected load reductions attributed to BMP implementation are achieved (e.g., BMP performance data).
- The permit should also provide a mechanism to make adjustments to the required BMPs as necessary to ensure their adequate performance.

This memorandum is organized as follows:

(I). Regulatory basis for including NPDES-regulated storm water discharges in WLAs in TMDLs;

(II). Options for addressing storm water in TMDLs; and

(III). Determining effluent limits in NPDES permits for storm water discharges consistent with the WLA

(I). Regulatory Basis for Including NPDES-regulated Storm Water Discharges in WLAs in TMDLs

As part of the 1987 amendments to the CWA, Congress added Section 402(p) to the Act to cover discharges composed entirely of storm water. Section 402(p)(2) of the Act requires permit coverage for discharges associated with industrial activity and discharges from large and medium municipal separate storm sewer systems (MS4), i.e., systems serving a population over 250,000 or systems serving a population between 100,000 and 250,000, respectively. These discharges are referred to as Phase I MS4 discharges.

In addition, the Administrator was directed to study and issue regulations that designate additional storm water discharges, other than those regulated under Phase I, to be regulated in order to protect water quality. EPA issued regulations on December 8, 1999 (64 FR 68722), expanding the NPDES storm water program to include discharges from smaller MS4s (including all systems within "urbanized areas" and other systems serving populations less than 100,000) and storm water discharges from construction sites that disturb one to five acres, with opportunities for area-specific exclusions. This program expansion is referred to as Phase II.

Section 402(p) also specifies the levels of control to be incorporated into NPDES storm water permits depending on the source (industrial versus municipal storm water). Permits for storm water discharges associated with industrial activity are to require compliance with all applicable provisions of Sections 301 and 402 of the CWA, i.e., all technology-based and water quality-based requirements. See 33 U.S.C. §1342(p)(3)(A). Permits for discharges from MS4s, however, "shall require controls to reduce the discharge of pollutants to the maximum extent practicable ... and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants." See 33 U.S.C. §1342(p)(3)(B)(iii).

Storm water discharges that are regulated under Phase I or Phase II of the NPDES storm water program are point sources that must be included in the WLA portion of a TMDL. See 40 C.F.R. § 130.2(h). Storm water discharges that are not currently subject to Phase I or Phase II of the NPDES storm water program are not required to obtain NPDES permits. 33 U.S.C. §1342(p)(1) & (p)(6). Therefore, for regulatory purposes, they are analogous to nonpoint sources and may be included in the LA portion of a TMDL. See 40 C.F.R. § 130.2(g).

(II). Options for Addressing Storm Water in TMDLs

Decisions about allocations of pollutant loads within a TMDL are driven by the quantity and quality of existing and readily available water quality data. The amount of storm water data available for a TMDL varies from location to location. Nevertheless, EPA expects TMDL authorities will make separate aggregate allocations to NPDES-regulated storm water discharges (in the form of WLAs) and unregulated storm water (in the form of LAs). It may be reasonable to quantify the allocations through estimates or extrapolations, based either on knowledge of land use patterns and associated literature values for pollutant loadings or on actual, albeit limited, loading information. EPA recognizes that these allocations might be fairly rudimentary because of data limitations.

EPA also recognizes that the available data and information usually are not detailed enough to determine waste load allocations for NPDES-regulated storm water discharges on an outfall-specific basis. In this situation, EPA recommends expressing the wasteload allocation in the TMDL as either a single number for all NPDES-regulated storm water discharges, or when information allows, as different WLAs for different identifiable categories, e.g., municipal storm water as distinguished from storm water discharges from construction sites or municipal storm water discharges from City A as distinguished from City B. These categories should be defined as narrowly as available information allows (e.g., for municipalities, separate WLAs for each municipality and for industrial sources, separate WLAs for different types of industrial storm water sources or dischargers).

(III). Determining Effluent Limits in NPDES Permits for Storm Water Discharges Consistent with the WLA

Where a TMDL has been approved, NPDES permits must contain effluent limits and conditions consistent with the requirements and assumptions of the wasteload allocations in the TMDL. See 40 CFR § 122.44(d)(1)(vii)(B). Effluent limitations to control the discharge of pollutants generally are expressed in numerical form. However, in light of 33 U.S.C. §1342(p)(3)(B)(iii), EPA recommends that for NPDES-regulated municipal and small construction storm water discharges effluent limits should be expressed as best management practices (BMPs) or other similar requirements, rather than as numeric effluent limits. See *Interim Permitting Approach for Water Quality-Based Effluent Limitations in Storm Water Permits,* 61 FR 43761 (Aug. 26, 1996). The Interim Permitting Approach Policy recognizes the need for an iterative approach to control pollutants in storm water discharges. Specifically, the policy anticipates that a suite of BMPs will be used in the initial rounds of permits and that these BMPs will be tailored in subsequent rounds.

EPA's policy recognizes that because storm water discharges are due to storm events that are highly variable in frequency and duration and are not easily characterized, only in rare cases will it be feasible or appropriate to establish numeric limits for municipal and small construction storm water discharges. The variability in the system and minimal data generally available make it difficult to determine with precision or certainty actual and projected loadings for individual dischargers or groups of dischargers. Therefore, EPA believes that in these situations, permit limits typically can be expressed as BMPs, and that numeric limits will be used only in rare instances.

Under certain circumstances, BMPs are an appropriate form of effluent limits to control pollutants in storm water. See 40 CFR § 122.44(k)(2) & (3). If it is determined that a BMP approach (including an iterative BMP approach) is appropriate to meet the storm water component of the TMDL, EPA recommends that the TMDL reflect this.

EPA expects that the NPDES permitting authority will review the information provided by the TMDL, see 40 C.F.R. § 122.44(d)(1)(vii)(B), and determine whether the effluent limit is appropriately expressed using a BMP approach (including an iterative BMP approach) or a numeric limit. Where BMPs are used, EPA recommends that the permit provide a mechanism to require use of expanded or better-tailored BMPs when monitoring demonstrates they are necessary to implement the WLA and protect water quality.

Where the NPDES permitting authority allows for a choice of BMPs, a discussion of the BMP selection and assumptions needs to be included in the permit's administrative record, including the fact sheet when one is required. 40 C.F.R.§§ 124.8, 124.9 & 124.18. For general permits, this may be included in the storm water pollution prevention plan required by the permit. See 40 C.F.R. § 122.28. Permitting authorities may require the permittee to provide supporting information, such as how the permittee designed its management plan to address the WLA(s). See 40 C.F.R. § 122.28. The NPDES permit must require the monitoring necessary to assure compliance with permit limitations, although the permitting authority has the discretion under EPA's regulations to decide the frequency of such monitoring. See 40 CFR § 122.44(i). EPA recommends that such permits require collecting data on the actual performance of the BMPs. These additional data may provide a basis for revised management measures. The monitoring data are likely to have other uses as well. For example, the monitoring data might indicate if it is necessary to adjust the BMPs. Any monitoring for storm water required as part of the permit should be consistent with the state's overall assessment and monitoring strategy.

The policy outlined in this memorandum affirms the appropriateness of an iterative, adaptive management BMP approach, whereby permits include effluent limits (e.g., a combination of structural and non-structural BMPs) that address storm water discharges, implement mechanisms to evaluate the performance of such controls, and make adjustments (i.e., more stringent controls or specific BMPs) as necessary to protect water quality. This approach is further supported by the recent report from the National Research Council (NRC), *Assessing the TMDL Approach to Water Quality Management* (National Academy Press, 2001). The NRC report recommends an approach that includes "adaptive implementation," i.e., "a cyclical process in which TMDL plans are periodically assessed for their achievement of water quality standards" . . . and adjustments made as necessary. *NRC Report* at ES-5.

This memorandum discusses existing requirements of the Clean Water Act (CWA) and codified in the TMDL and NPDES implementing regulations. Those CWA provisions and regulations contain legally binding requirements. This document describes these requirements; it does not substitute for those provisions or regulations. The recommendations in this memorandum are not binding; indeed, there may be other approaches that would be appropriate in particular situations. When EPA makes a TMDL or permitting decision, it will make each decision on a case-by-case basis and will be guided by the applicable requirements of the CWA and implementing regulations, taking into account comments and information presented at that time by interested persons regarding the appropriateness of applying these recommendations to the particular situation. EPA may change this guidance in the future.

If you have any questions please feel free to contact us or Linda Boornazian, Director of the Water Permits Division or Charles Sutfin, Director of the Assessment and Watershed Protection Division.

cc: Water Quality Branch Chiefs Regions 1 - 10

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